

STUDIES IN CYPERACEAE IN SOUTHERN AFRICA: 10. THE GENUS *KYLLINGA* ROTTB.

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ABSTRACT

A review of the taxonomic history of the genus *Kyllinga* Rottb. is given. Diagnostic criteria are discussed and emphasis laid on the morphology of the underground parts as key characters. Fourteen species are described including two new records for the area, *K. polyphylla* Willd. ex Kunth and *K. nemoralis* (Forst.) Dandy. A key to the genus in South Africa is provided.

UITTREKSEL

STUDIES VAN CYPERACEAE IN SUIDELIKE AFRIKA: 10. DIE GENUS *KYLLINGA* ROTTB.

'n Oorsig van die taksonomiese geskiedenis van die genus *Kyllinga* Rottb. is gelever. Diagnostiese kenmerke word bespreek en nadruk word op die ondergrondse dele gelê. Viertien spesies word beskryf insluitende twee nuwe rekords vir die gebied, naamlik *K. polyphylla* Willd. ex Kunth en *K. nemoralis* (Forst.) Dandy. 'n Sleutel tot die genus in Suid-Afrika word verskaf.

Key words: *Kyllinga*, Cyperaceae, southern Africa

Generic limits within the Cyperaceae have frequently been subject to differing taxonomic interpretations. *Kyllinga* Rottb. is no exception having been treated as a genus (Vahl, 1806; Nees, 1835/6), united with *Mariscus* Gaertn. (Boeckeler, 1868) and placed in the genus *Cyperus* L. together with *Mariscus*, *Pycneus* Beauv. and *Juncellus* C. B. Clarke (Kükenthal, 1936; Koyama, 1961). This latter treatment has not enjoyed universal acceptance however, and has been challenged on chemical grounds (Allan *et al.*, 1978). In the absence of the unequivocal evidence to support Kükenthal's decision, *Kyllinga* will be maintained at the generic level in this account.

The name *Kyllinga* Rottb. has been conserved in preference to *Thryocéphalum* J. R. and G. Forst. (1776) despite an earlier homonym *Kyllinga* Adans. (Apiaceae) (Lanjouw, 1978). Rottbøll (1773) described *Kyllinga* and five species of which *K. monocephala* was the first mentioned. This species

has been designated the type species (Lanjouw, l.c.) with the correct name *K. nemoralis* (Forst.) Dandy (Dandy, 1935).

Vahl (1806) included Central African species in his list of seven *Kyllinga* species, but the earliest record of South African species was given by Nees (1835/6) with a description of four new species of *Kyllingia*, a spelling now rejected in favour of *Kyllinga*. Kunth (1837) recorded twenty-eight species, commenting that the genus differed from *Pycnus* only in the number of florets, while Boeckeler (1868) gave a rather broader view by including in *Kyllinga* the genus *Mariscus* with its three style branches where *Kyllinga*, in the strictest sense, has two. Bentham and Hooker (1883) and Engler and Prantl (1889) restored *Mariscus* to generic status.

The first comprehensive account of the genus in southern Africa, however, was that of Clarke (1897) which followed his publication of a list of twenty-one African species (1895) and his contribution of six species of African and Indian origin (1893). In his synopsis of the genus, Clarke (1897) recognised three subgenera; *Pseudo-Pycnus*, *Eukyllinga* and *Thryocephalum*, number of nutlets and presence or absence of a wing on the glumes being the diagnostic characteristics. Ten species were recognised but in 1901, Clarke presented a second major account in which thirty-eight tropical species were recognised. This was followed by a species list (1908) and illustrations (1909).

Kyllinga was included in accounts by Schonland (1922) and Brain (1931), but the next major study of the genus was that of Kükenthal (1936) in which the genus *Kyllinga* was reduced to a subgenus of *Cyperus* together with *Mariscus*, *Torulinium*, *Juncellus*, *Pycnus* and *Eucyperus*. The subgenus *Kyllinga* sensu Kükenthal, was further subdivided into sections reflecting Clarke's classification (1897) and within section *Eukyllinga*, three groups were defined on the basis of rhizome characteristics. The arrangement of the three sections suggests an evolutionary progression involving a reduction in number of florets per spikelets and the development of a wing on the keel of the fertile glume.

Koyama (1961) followed Kükenthal adding only the genus *Lipocarpha* R. Br. to the list of those sunk into *Cyperus* sensu Kükenthal. Kern (1974) also included *Kyllinga* within *Cyperus*, but other authors (Podlech, 1960 and Hooper, 1972) do not agree, preferring to retain *Kyllinga* as a separate genus. This latter policy is adopted here.

The genus *Kyllinga* Rottb. is an essentially African genus, but three species are recorded from tropical America and India, four endemic species from the West Indies and seven endemic to the Malagasy Republic. Fourteen species are represented in southern Africa.

Members of the genus may be recognised in the field by their single, compact inflorescence and distinguished from similar forms in *Mariscus* by

their paired style branches. The underground organs, in particular, have a characteristic smell faintly reminiscent of lemon. Each spikelet comprises a pair of sterile glumes (the lower bract and prophyll) subtending distichously arranged fertile glumes. The lowest floret is bisexual, consisting of an ovary with two style branches and three (or 2 or 1) stamens. The upper floret may be male or, rarely, bisexual. Most species produce a single nutlet from the fertile bisexual flower but *K. pulchella* Kunth has 2-4 bisexual flowers and may produce 2 nutlets. There are no hypogynous bristles.

DIAGNOSTIC CRITERIA

Emphasis has been placed on spikelet form, number of nuts, the wing on the keel of the glume and the perennating organs. Each of these was studied and will be discussed together with other characters found to be of interest.

Kyllinga is distinguished from neighbouring genera by its single compact inflorescence of sessile spikelets. In general, this is a consistent feature of the genus though species such as *K. polyphylla* Willd. ex Kunth and *K. elatior* Kunth frequently have minor sessile heads in the axils of lower inflorescence bracts. Two aberrant collections have been made; one a triple head in *K. alba* Nees and one collection of *K. alata* Nees with two peduncled, minor heads reminiscent of *Mariscus*. These are, however, not consistent features for these species.

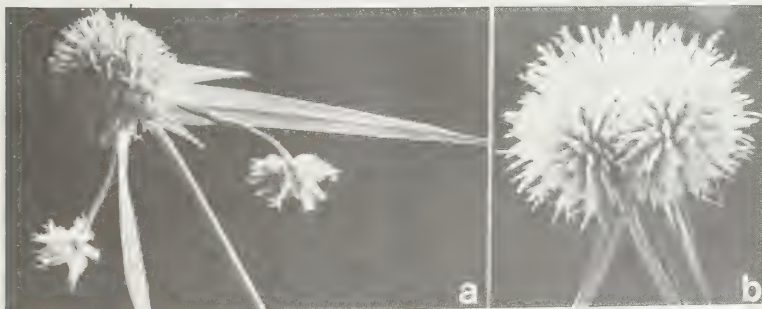


FIG. 1

Anomalous inflorescences of *Kyllinga* species. A. *K. alata* from the Bluff grasslands, Durban. B. *K. alba* from the Lebombo Mountains.

The shape of the inflorescence is useful in separating species. *K. elatior* and *K. odorata* Vahl invariably have cylindrical heads while all the other species have spheroidal heads. Colour is also useful if used with caution. *K. alata* invariably has golden spikelets with green keels giving a characteristic golden inflorescence and *K. pulchella* has deep red inflorescences. *K. odorata*

inflorescences are white when mature, as are those of *K. alba*. In *K. alba* however, some discolouration is possible with cinnamon spots appearing. Associated with the inflorescence are leafy bracts which are useful key characters in some species. The orientation of three stiff bracts, erect at first and later reflexing to a 45° angle, is characteristic of *K. erecta* Schum., *K. intricata* Cherm., *K. brevifolia* Rottb., *K. melanosperma* Nees, and *K. pauciflora* Ridl.. *K. elatior* is easily recognised in the field by its long, horizontally-orientated bracts, but this is not always as apparent in herbarium material and rhizome and inflorescence shape are more reliable here.

Spikelet features have been used as diagnostic features at the subgeneric level and to distinguish species. One of these features was the number of bisexual flowers and thus the number of nutlets per spikelet. In these respect, *K. pulchella* is unique amongst the southern African species in bearing 2–4 (as opposed to one) fertile floret per spikelet.

Kyllinga florets usually include three stamens, but three South African species differ from the norm. *K. brevifolia* invariably has one stamen per floret and *K. odorata* two. *K. welwitschii* Ridley has one or two.

The presence of a wing on the keel of the fertile glumes has been used to define the subgenus *Thryocephalum* (Clarke, 1901) and particular attention has been given to this characteristic. Within a population variation may be very slight, but comparisons of individuals from different populations over the range of distribution of *K. alba* and *K. alata* showed considerable variation (see Figure 2). As a diagnostic criterion some caution must be exercised when using this characteristic. In the present study, wing width was found to be a function of the age of the spikelets of *K. alba* and thus is not a useful diagnostic or key character when dealing with herbarium specimens of this species.

As with many members of the Cyperaceae, the rhizome or other perennating underground stems have proved to be invaluable aids to identification. Indeed, with experience of the genus it is usually possible to make accurate specific identifications of vegetative material on this basis alone.

The term "rhizome" has been used somewhat loosely in the past to describe many types of modified stem found in the genus. In this account, "rhizome" is reserved for those stems which are dorsiventral, creeping, main axes, prostrate on or under the ground, progressively producing aerial shoots in a sympodial pattern. Such rhizomes, however, can be separated into three groups.

- i. Slender elongated rhizomes producing aerial shoots every other node. These are clothed in leaflike scales which may or may not overlap. Examples of this form of rhizome are to be found in *K. elatior*, *K. brevifolia* and *K. intricata* [Fig. 3 (a)].
- ii. Slender or stout compact rhizomes bearing aerial shoots at each

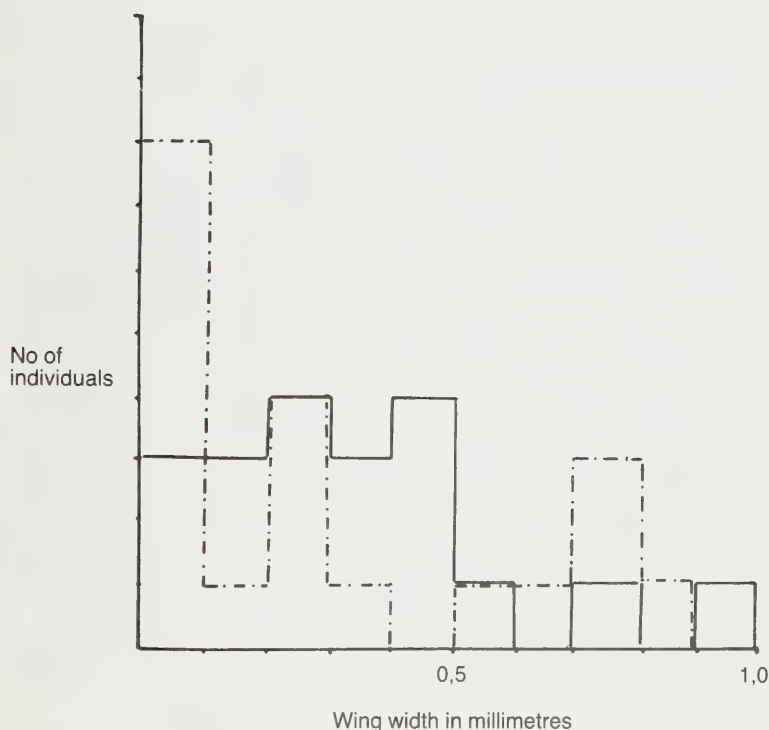


FIG. 2

The range of wing width distribution in twenty individuals of *K. alba* (solid line) and *K. alata* (dotted line).

node. Examples of this type are to be found in *K. erecta*, *K. melanosperma* and *K. polyphylla*. [Fig. 3 (b)].

- iii. Uniseriate rows of woody stem-bases or tufts of woody stem-bases clothed in fibrous sheaths as are found in *K. alba*, *K. alata* and *K. odorata*, all three of which are associated with grasslands. [Fig. 3 (c)].

In contrast to these, three species possess stolons. These lateral branches arise at or below the surface and radiate from the mother plant producing aerial shoots some distance from the mother plant. *K. albiceps* (Ridley) Rendle and *K. pulchella* have extremely slender stolons which are frequently damaged unless collected with great care. Those of *K. nemoralis* are more robust [Fig. 3 (d)].



FIG. 3

Underground portions of *Kyllinga* species: a. Elongated rhizomes of *K. elatior*. b. Congested rhizomes of *K. polyphylla*. c. Stem-bases of *K. alba*. d. Stolons of *K. nemoralis*. Scale in each case is equivalent to 10 mm.

The problems of imposing a single-character classification upon a variable genus such as this are evident when considering the subgenera of *Kyllinga*.

Choice of a wing on the keel of the glume to distinguish subgenus *Alata* cannot be upheld in view of the range of variation found. The use of number of nuts to define subgenus *Pseudo-Pycreus* is difficult to justify when some species have one or two nuts. In this account therefore, subgenera are not recognised. If any characteristic were chosen to distinguish groups within this genus, it would be the underground stem, but even here it would lead to artificial groups.

At the species level, however, the nature of the underground stem has been very useful, together with inflorescence form including shape of head, bract and colour.

- Plants rhizomatous; rhizome either congested or elongated; stem-bases not clothed in fibrous sheaths 9
6. Inflorescence cylindrical; stamens 2 or 1 per floret 7
- Inflorescence globose; stamens 3 8
7. Inflorescence pale green to buff when dry; central spike 4–7 mm long; keel of glume ciliate to slightly winged in older spikelets; anthers 1 or 2 per floret; nut narrowly ellipsoid, golden *K. welwitschii* Ridley
- Inflorescence white; central spike 8–16 mm long; keel of glume wingless, glabrous or with 1 or 2 hairs; anthers 2 per floret; nut broadly obovoid, yellow when young turning red-brown later black *K. odorata* Vahl.
8. Inflorescence golden-green, spikelets usually markedly winged *K. alata* Nees
- Inflorescence white or cinnamon *K. alba* Nees
9. Rhizome slender, aerial stems distant from one another, produced every other node 10
- Rhizomes compact, aerial stems contiguous, produced at every node 12
10. Stamens 1 per floret; rhizome slender, white with pale brown scales shorter than internodes *K. brevifolia* Rottb.
- Stamens 3 per floret rhizomes not as above 11
11. Inflorescence with 1–3 spikes, central spike elliptic or cylindrical; bracts long (up to 290 mm), horizontally orientated; rhizome 2–3 mm in diam. with transparent membranous scales with striate markings *K. elatior* Kunth
- Inflorescence 1 globose to ovate head; bracts 3 short, lowest erect and later reflexed; rhizome 1–2 mm in diameter with loose, red-brown, overlapping scales *K. intricata* Cherm.
12. Plants generally less than 400 mm; rhizome a row of bulbous-based, contiguous stems clothed in scales (when dry, stem-bases shrunken within the scales), inflorescence a single, globose, golden or green spike . *K. erecta* Schum.
- Plants generally taller, 300–640 mm; rhizome compact, stout (5–8 mm in diameter) not shrinking conspicuously when dried; inflorescence either cylindrical or a group of ovoid or globose heads 13
13. Inflorescence 1, usually cylindric, yellow-green, but subglobose and rust streaked under unfavourable conditions, subtended by 3 stiff erect bracts reflexing to 45° with stem later, with possible 4th very short (120 mm long) bract *K. melanosperma* Nees
- Inflorescence invariably of more than 1, sessile, globose, green spikes subtended by 3–8 spreading bracts, 130–210 mm long *K. polyphylla* Wild. ex Kunth

1. *K. pauciflora* Ridley in Trans. Linn. Soc Ser. 2, 2: 147, t.23, fig 1–4 (1884); C.B. Clarke in Durand and Schinz, Conspect. Fl. Afr. 5:530 (1895), in Thistleton-Dyer, Fl. Cap. 7:152 (1897) and in Flora Trop. Afr. 8:273 (1902), Rendle, Catal. Afr. Pl. Welw. 2:105 (1899); Medley Wood in Trans. S.A. Phil. Soc. 18, 2:250 (1908). Type: Angola, *Welwitsch 6811* (BM, holo.).

Cyperus ridleyi Mattf. and Kükenth. in Engler, Pflanzenr. 20:599 (1936).

Rhizome slender, creeping, elongated, or stems congested and tufted. *Culms* slender, 80–600 mm tall, base scarcely thickened, covered with few sheaths. *Leaves* few, shorter than culm, blades narrow (1–3 mm wide), acuminate. *Bracts* 3, short (30–100 mm) lowest upright, others spreading.

Inflorescence of 1 sub-lateral spike, lax, rarely more than 15 spikelets, golden-green, often exhibiting adventitious plantlets. *Spikelets* long for the genus: 3,4–6,54 mm, ovate-lanceolate in outline, fertile glumes 2, unequal, well developed, plus third upper reduced glume; lower glume 7–9-nerved, subtending bisexual floret, middle 5–7-nerved subtending male (rarely bisexual floret), upper empty; keels green, glabrous or slightly spinulose, excurrent into pointed slightly recurved mucro (0,20 to 0,72 mm). *Stamens* 2, anther connective slightly produced. *Style* long but often exceeded in length by style branches. *Nut* 1, half length of glume, obovoid, golden-brown.

TRANSVAAL—2330 (Tzaneen): Rosendal Dam, Letaba District (-CD), *Scheepers* 1190 (PRE).

—2730 (Vryheid): Wakkestroom (-AC), *Devenish* 952 (PRE).

NATAL—2829 (Harrismith): Cathedral Peak Forest Reserve (-CC), *Killick* 1103, 1273 (NH, NU).

—2929 (Underberg): Estcourt district, Hlatikulu, Giants Castle area (-BA), *Edwards* 2242 (PRE); Ntabamthlope vlei, Estcourt (-BC), *Downing* 124, 142, 153, 156 (NU), *Getliffe* 298 (NU); Mpendhle, Tillietudlem (-DB), *Huntley* 443 (NU).

—2930 (Pietermaritzburg): Lions River district, roadside near Rawdon's Hotel (-AC), *Gordon-Gray s.n.* (NU), *Getliffe* 224 (NU); Hermansberg district, vlei near school (-BB), *Getliffe* 174 (NU).

K. pauciflora was described as "having the habit of one of the few flowered *Marisci* while the spikelets suggest those of *K. aurata* Nees" Ridley (1884). It was distinguished on the basis of its longer spikelets, few in number, and the presence of "vivipary". (Fig 4b.)

The identity of several Natal gatherings with lax golden inflorescences of very few spikelets (*Huntley* 443, *Killick* 1273 and *Willd* 1439), a gathering from Zimbabwe, has been subject to some debate. Kew determinations placed them in *K. pauciflora* but Robinson (1959) associated them with *K. intricata*. Robinson also suggested that some of his gatherings deserved specific rank as a new species (sp. viii).

Examinations of the Natal specimens and of populations in the field showed that they could not satisfactorily be placed with *K. intricata* as they possessed a more congested rhizome and inflorescences of a maximum of 20 spikelets. The phenomenon called vivipary by Ridley (loc. cit.) was well represented in the Natal populations. Comparison with Robinson's proposed "species viii" suggested these were very similar.

The production of adventitious plantlets is a conspicuous feature of these populations and may be associated with the end of the growing season or with waterlogged conditions. Rhizome structure is interesting and may also exhibit seasonal variation. Elongate internodes of older rhizomes terminate in a cluster of closely packed culms. Herbarium specimens may include both portions if adequately collected or just the terminal congested young por-

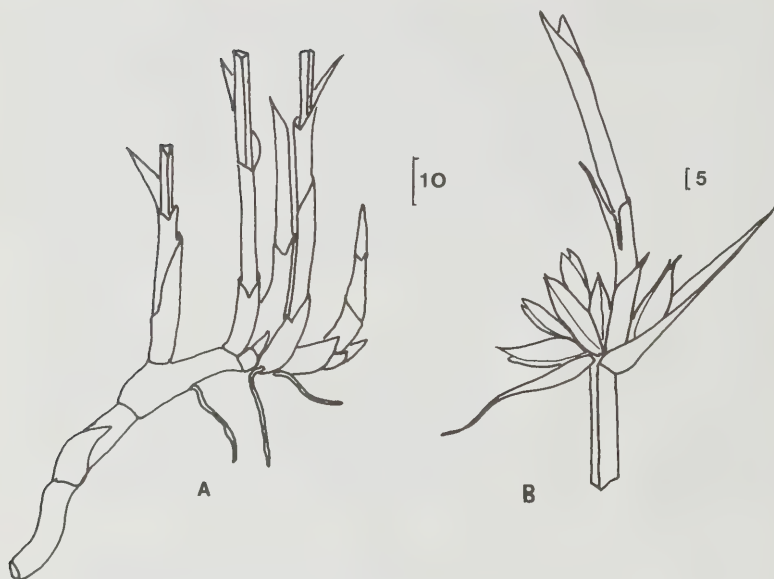


FIG. 4

A. Morphology of the rhizome of *K. pauciflora* with congested stems in young portion and elongated older portions. B. Vegetative shoot replacing one of the few spikelets in the head. Scales in millimetres.

tions. The unique combination of vegetative reproduction and few flowers suggests that all these belong to *K. pauciflora*.

Ridley (1884) commented on the longer spikelets of *K. pauciflora* and a comparison of our material with tropical *K. pauciflora* showed a tendency for our material to have slightly smaller spikelets. There is however no clear distinction between the tropical material averaging 5.09 mm, Robinson's "sp. viii" averaging 4.8 mm and the Natal gatherings averaging 4.13 mm but rather a gradual decrease in size towards the southern limits.

No detailed studies of the breeding strategies of these populations have been carried out to date and the correlation of vegetative propagation with waterlogged marshy conditions has been observed frequently with this and other species, but not tested. Nor can one entirely rule out the possibility that the Natal populations represent hybrid swarms possibly derived from *K. erecta* Schum. Until these questions are resolved, it is proposed that the material be retained in *K. pauciflora* Ridley.

2. **K. pulchella** Kunth, Enum. Pl. 2: 137 (1837); Boeck in Linnaea 35: 405 (1868); C. B. Glarke in Durand and Schinz, Conspect. Fl. Afr. 5: 531 (1895), in Thiselton-Dyer, Fl. Cap. 7: 154 (1897), in Thiselton-Dyer, Flora Trop. Afr. 8: 284 (1901) and in Kew Bull. Addit. Ser. 8: 94 (1908); Burt Davy and Pott-Leendertz in Ann. Tvl. Mus. 132 (1912); Phillips in Ann. S. A. Mus. 16: 319 (1917); Podlech, in Merxm. et al., Prodr. Fl. Südwestafr. 165: 31 (1970). Type: Cape, Albert Division, Drège 7384 (K!, holo.).

K. atrosanguinea Steud. in Flora 598 (1842) and Syn. Pl. 2: 69 (1855). Type: Ethiopia, Schimper 1269.

Cyperus teneristolon Kükenth., in Engler, Pflanzenr. 4, 20: 574 (1936).

Stolons very slender (less than 1 mm in diam.). *Stem-bases* slightly thickened. *Culms* slender, up to 430 mm tall, triangular, solitary or in small groups, glabrous, glaucous-green, leafy at base. *Leaves* often as long as culms, glabrous, flaccid. *Bracts* 3–4 (see footnote), leaflike, lowest erect, up to 120 mm long, others shorter spreading. *Inflorescence* 1–3 spikes, sublatera when immature, middle spike ovate, up to 16 mm long and 10 mm wide, dark red. Spikelets many, 3–5 mm long, spreading, 3–5 fertile glumes, 2–4 bisexual florets, 3–1 nuts. *Fertile glumes* ovate in outline, lowest 9-nerved, middle 7-nerved, upper 3–5-nerved; keel green or greenish-yellow, wingless, glabrous or with few hairs, excurrent into short mucro. *Stamens* 3, anthers linear, long, connective produced. *Style* long, exerted, stigmas 2. *Nut* ellipsoid to obovoid, half length of glume, chestnut brown.

TRANSSVAAL—2628 (Johannesburg): Frankenwald (-AA), Gilliland 25055 (PRE); Boksburg (-AB), Munay s.n. (PRE 29315).

—2729 (Volksrust): 29 km from Volksrust on Amersfoort Road (-BD), Hilliard 2991 (NU).

Without precise locality: Schlechter 5529 (PRE).

ORANGE FREE STATE—2926 (Bloemfontein): Reddersburg district (-CA), Acocks 18696 (PRE).

NATAL—2828 (Bethlehem): Royal Natal National Park (-DB), Getliffe 22 (NU).

—2929 (Underberg): Mpendhle, 20 km from Dargle (-DB), Moll 680 (NU).

—2930 (Pietermaritzburg): Lions River district, Karkloof (-AC), Gordon-Gray s.n. (NU); Mount Gilboa, Karkloof, Getliffe 2058 (NU).

LESOTHO—2929 (Underberg): Sehlabathebe Reserve (-CC), Jacot Guillarmod, Mzamane and Getliffe 91 (PRE, INCOL).

CAPE—3025 (Colesberg): 16 km SW Colesberg (-CA), Acocks 16310 (PRE).

—2337 (Stutterheim) Mount Cume, Dohne (-CB), Acocks 9495 (PRE); Hilner 359 (PRE); Komgha (-DB), Flanagan 1261 (K, NH, PRE).

Also found in Ethiopia, Kenya and Tanzania.

Acocks 18696 consisted of two plants one of which has about 14 bracts. Each of the four heads comprising the inflorescence appears to have a full complement of bracts. This is, however, an exception to the general rule that bract number in the species is 3 or 4.

Kyllinga pulchella is distinguished from all other southern African species by its dark red inflorescences. It has not been widely collected though Clarke (1901) remarked that it was "frequent in South Africa". Careful collection is necessary to include the characteristic delicate stolons. A tropical species of *K. anomala* Peter & Kükenth. may be its nearest relative, but is distinguished from *K. pulchella* by its peduncled axillary spikes and red keels to the glumes whereas those in *K. pulchella* are green. These distinctions may not be sound and Napper (1971) has amalgamated both into *K. pulchella*. *K. pulchella* is a distinct species in South Africa differing from the only other species with slender stolons, *K. albiceps*, in the striking red colour of its spikes.

3. ***K. nemoralis*** (J.R. and G. Forster) Dandy, ex Hutchinson and Dalziel, Flora W. Trop. Afr. 2, 2: 487 (1936), Nelves and Baldwin in Amer. Journ. Bot. 39: 389 (1952), Hooper in Hepper, Flora W. Trop. Afr. ed. 2, 3: 307 (1972)

Thryocephalon nemorale J. R. and G. Forster, Charact. Gen. Pl. 129, t 65 (1776).

Kyllinga monocephala Rottb., Desc and Icon Nov. Pl. 13, fig 4 (1773); Nees, in Wight, Contrib. Bot. of India 91 (1834); Kunth, Enum. Pl. 2: 129 (1837); Steud., Synops. Cyp. 2: 67 (1855); Boeck. Linnaea 35: 427 (1868) p.p, Ridl. in Trans. Linn. Soc. 2. Ser Bot 2: 147 (1884); C. B. Clarke, in Hooker, Fl. Brit. Ind. 6: 588 (1893), in Durand and Schinz, Conspect. Fl. Afr. 8: 530 (1895), in Thiselton-Dyer, Fl. Trop. Afr. 7: 272 (1902) and Illustr. Cyp. t ii. f 1-2 (1909); Chermeson, Catal. Pl. Madag. 8 (1931). Type: Rottb., Desc. et Icon. Nov. Pl. 13, fig. 4. (Iconotype).

Cyperus kyllinga (Endl.) Kükenth., in Engler Pflanz. 4, 20:606 (1936).

Plants with stolons, 10-100 mm long, slender, white and pliable when fresh, fragrant, about 2 mm in diam., with membranous, pink-brown, striate scales, developing fine feathery roots. *Culms* usually distant, occasionally clustered, 40-570 mm tall, flaccid (except Getliffe 193), triangular, bases not thickened. *Leaves* usually shorter than culms, sheaths membranous, greenish pinkish-brown, striate; blades 3-5 mm wide, flat, margins and keels scabrid particularly near apex, flaccid (except Getliffe 193). *Bracts* 3-4, 1 100-1 300 mm long, clasping inflorescences, upright later reflexed or spreading. *Spikelets* many, ovate elliptic in outline, 2.95-5 mm long, floret 1 bisexual rarely second male floret, fertile glumes 2 sometimes with third reduced hyaline glume, sides of both well-developed glumes obscurely nerved, 3-4 prominent nerves close to thick fleshy green winged keel that is excurrent into slightly recurved mucro 0.5-0.8 mm long; wing 0.1-0.15 mm wide, spinulose. *Stamens* 3. *Style* long, slender, bifid. *Nut* 1, less than $\frac{1}{2}$ length of

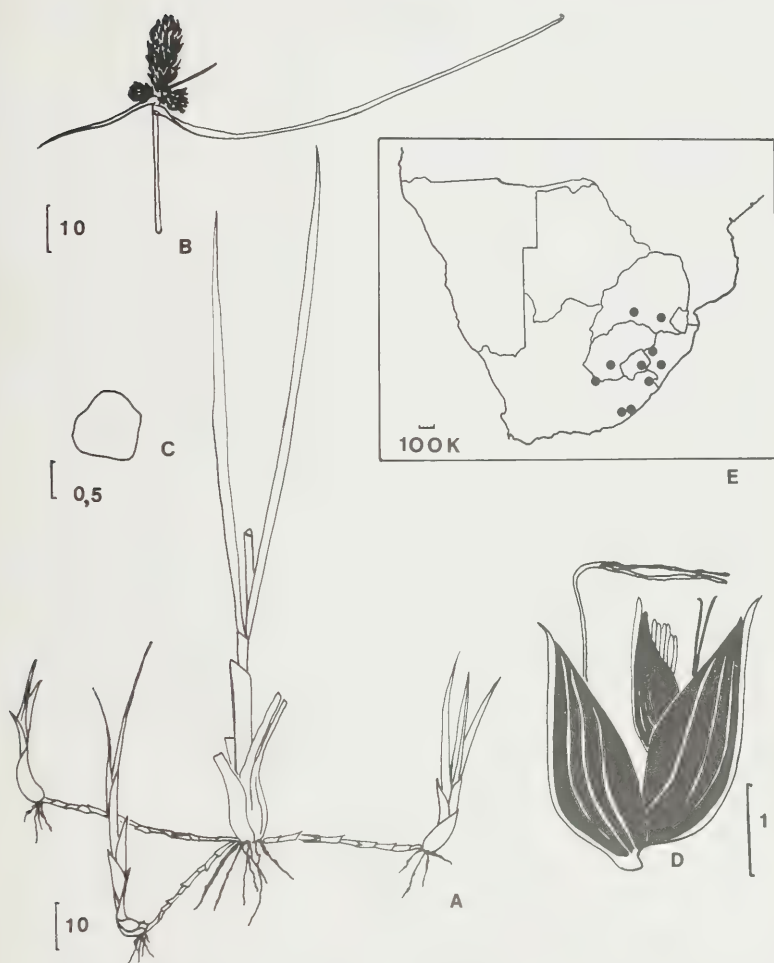


FIG. 5

Morphology and distribution of *K. pulchella* in southern Africa. A. Basal portion of a shoot with slender stolons terminating in erect shoots. B. Multiple heads often found in this species. C. Cross-sectional outline of the culm. D. Dark red spikelet (lower empty glumes, a bract and prophyll, removed) with three fertile glumes maturing at least two nutlets. E. Distribution of *K. pulchella* in southern Africa. Figure scales in millimetres; map scale in kilometres.

spikelet, obovoid to oblong, butter yellow turning red-brown, later black, slightly apiculate.

NATAL—2832 (Mtubatuba): 16 km N of Mtubatuba (-AC), *Getliffe 59, 123* (NU); Dukuduku (-AD), *Ward s.n.* (NU).

—2930 (Pietermaritzburg): Isipingo Beach (-DD), *Ward 1250* (NU).

—2931 (Stanger): Durban Country Club Golf Course (-CC), *Getliffe 193* (NU); Durban Botanic Garden, *Getliffe 996* (J).

K. nemoralis has been described as "very general in warmer parts of the Old World particularly near the sea" (Clarke, 1897) and as a weed of secondary forest and disturbed areas (Hooper, 1972). Clarke (1897) cited only two doubtful records from Africa but it has subsequently been included in accounts of African material (Kükenthal, 1936; Napper, 1971; Hooper, 1972b) with the most southern record in Mozambique. During this investigation five records of this species have been studied. All were coastal, two in areas which have been subject to considerable disturbance (a golf course and a densely populated resort) and a third on the fringe of a pond in the Botanic Garden where it is frequently mowed.

These Natal gatherings agree with descriptions of *K. nemoralis* though the term stolon is preferred here to "slender rhizome" (Napper, 1971). One distinctive feature not previously recorded for this species, is the presence of "vivipary" in these populations. Small adventitious propagules arise in the inflorescence, apparently replacing a spikelet. In *Cyperus prolifer* Lam., this phenomenon was observed to be correlated with disturbance and waterlogging (Getliffe & Baijnath, 1976). In *Kyllinga nemoralis* it may reflect a reaction to similar conditions. Once again, the underground portions are the key diagnostic character and this is not always included in herbarium specimens. Without reference to these slender stolons the species may be confused with *K. brevifolia* or *K. elatior*, but it differs from both in the presence of a winged keel to the glumes. Its fleshy stolons distinguish it from the other stoloniferous species, *K. pulchella* and *K. albiceps*, in which the stolons are very slender.

4. *K. albiceps* (Ridley) Rendle in Cat. Afr. Pl. Welw. 2: 106 (1896), C. B. Clarke in Thiselton-Dyer, Flora Trop. Afr. 8: 286 (1901); Hutchinson in Flora W. Trop. Afr. 2, 2: 486 (1936).

K. macrocephala A. Rich var. *angustior* C. B. Clarke, Conspect. Fl. Afr. 5: 529 (1895). Type: *Scott Elliott 7626* (K, holo.!).

K. merxmuelleri Podlech, Mitt. Staatssamml. Münch. 3: 525 (1960), in Prod. Fl. Südwestaf. Fam. 165. L. 16:31 (1967). Type: Vley 16 ml Östlich Runtu. *Merxmueller and Giess 2136* (PRE, iso.!).

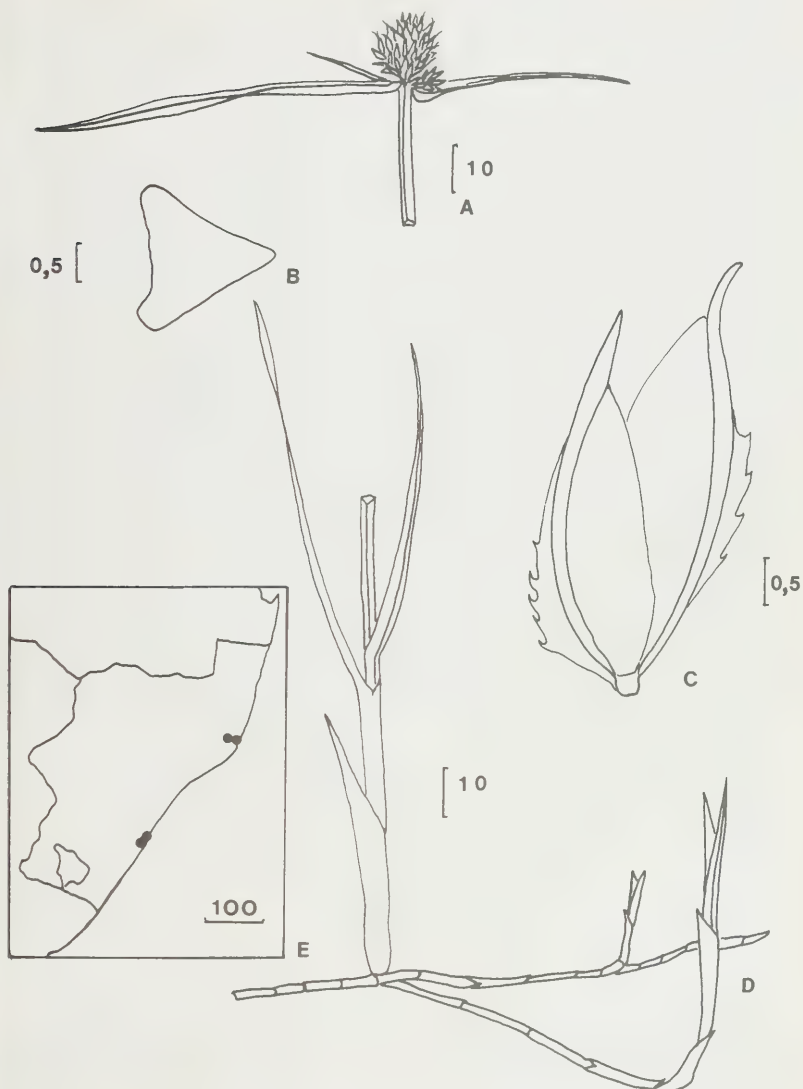


FIG. 6

Morphology and distribution of *K. nemoralis*. A. Inflorescence with lateral subsidiary spike. B. Cross-sectional outline of culm. C. Single winged spikelet (lower empty bract and prophyll removed). D. Portion of shoot with prominent stolons radiating from parent plant. E. Distribution along Natal coast. Figure scales in millimetres; map scale in kilometres.

Cyperus albiceps Ridley, Journ. Bot. 22: 16 (1884). Type: Congo, *Christian Smith* (BM, holo.).

Cyperus richardii Steud. var. *angustior* (C.B. Clarke) Kükenth. in Engler, Pflanzenr. 4, 20: 570 (1936).

Stem-bases woody, swollen, sheathed, stoloniferous. *Stolons* 1 mm wide, up to 500 mm long, covered with bracts which later split into fibres. *Culms* solitary, up to 300 mm long, slender, compressed triangular, glabrous, leafy at base. *Leaves* shorter than culms, 2–5 mm wide, flaccid, acuminate. *Bracts* 2–3, erect, later reflexed, leaflike, longest up to 95 mm long. *Inflorescence* of 1 globose or ovoid spike or 2–3 spikes confluent into subglobose head, up to 8 mm in diam, straw-coloured. *Spikelets* many, ovate-elliptical in outline, less than 3 mm long, 2-flowered, 2–3 fertile glumes. *Fertile glumes* straw-coloured, sometimes gland-dotted, 7–9-nerved, keel probably green when fresh, fading to straw, excurrent into short mucro. *Stamens* 3. *Style* almost equal in length to style branches. *Nuts* 2, ellipsoid to oblong, half length of glume, golden-brown.

S.W.A.—1719 (Runtu): Vley 16 ml Östlich Runtu (-DD), *Merxmüller and Giess* 2136 (PRE).

—1814/1816: Ovamboland, *de Winter and Giess* 6900 (PRE).

K. macrocephala var. *angustior* was differentiated from *K. macrocephala* by its smaller inflorescence and shorter spikelets but transferred by Clarke (1901) to *K. albiceps* (Ridley) Rendle with the remark that it differed very little from *K. macrocephala*, but for the slender stems. There are undoubtedly two entities here; a tropical group and one which also has a southern element. Both were examined and the difference in spikelet length and inflorescence length was confirmed. A more significant difference however is the difference in the number of bisexual florets. In *K. macrocephala*, more than two nutlets were produced while the group assigned to the variety of *K. albiceps*, have only two fertile florets. The type of Clarke's variety, *K. macrocephala* var. *angustior* (*Scott Elliott* 7626) bears the comment in Clarke's hand that it has three nuts. However, examination of this specimen could not confirm this and the material examined suggests that two nutlets are characteristic of the variety. The isotype of *K. merxmülleri* and a second gathering cited by Podlech (1960) were examined and found to agree in every respect with *K. albiceps* which epithet has precedence.

This species shares the delicately stoloniferous habit of *K. pulchella* but its buff inflorescences are readily distinguished from the dark red inflorescences of *K. pulchella*.

5. *K. welwitschii* Ridley, Trans. Linn. Soc. Ser. 2, 2: 147 (1884); Hooper in Hepper, Flora W. Trop. Afr. ed 2, 3: 305 (1972). Type: Angola, Pungo Andongo, *Welwitsch* 6796 (K, holo.; BM, iso.).

K. blepharinota Hochst. ex Boeck., in *Linnaea* 35: 414 (1868).

K. caespitosa Ridl. (non Nees) in *Trans. Linn. Soc. Ser. 2*, 2: 145 (1884).

K. triceps var. *ciliata* Boeck. in *Linnaea* 35: 414 (1868); C. B. Clarke in Durand and Schinz, *Conspect. Fl. Afr.* 5: 533 (1895) and in Thiselton-Dyer, *Flora Trop. Afr.* 8: 281 (1901); Kükenthal in Engler, *Pflanzenr.* 4, 20: 579 (1936). Type: Abyssinia, *Schimper* 2201.

K. controversa var. *subexalata* C. B. Clarke in Thiselton-Dyer, *Flora Trop. Afr.* 9: 271 (1901).

Cyperus controversus var. *subexalatus* (C. B. Clarke) Kükenth., in Engler, *Pflanzenr.* 4, 20: 612 (1936).

Plants tufted or with short row of thickened, woody, stem-bases clothed in persistent, tough sheaths. Culms 40–50 mm tall, very slender, triangular, furrowed, glabrous. Leaves shorter than culms, blades 1–2 mm wide, glabrous or margins and keel minutely scabrid, flaccid, markedly acuminate. Inflorescence of 3–1 spikes, pale green to buff-coloured when dry, dense; central oval, 4–7 mm long, lateral smaller, subglobose. Bracts 3, up to 8 mm long, sometimes with 1 additional, very reduced bract. Spikelets numerous, elliptic in outline, 1.5–2.5 mm long; fertile glumes 3; lowest subtending bisexual floret, white scarious gland-dotted, obscurely 5-nerved, keel probably green, scarcely excurrent into mucro, ciliate, slightly winged in older spikelets; middle glume fully developed, empty, otherwise as in lowest glume but 3-nerved; uppermost glume minute, hyaline. Stamens 2–1. Style and style branches shorter than mature nut, style branches exceed style in length. Nut 1, narrowly ellipsoid, approximately 1.5×0.5 mm, golden.

S.W.A.—2115 (Karibib): Okongava, Granitbank (-BB?), *Dinter* 6961 (PRE); Farm Neuschwaben (-DD), *Kinge* 3048 (PRE).

Also found in West Africa, Tanzania and Mozambique.

The taxonomic delimitation of *K. welwitschii* Ridley has had a varied history. Clarke (1895) cited, under *K. triceps* var. *ciliata*, nineteen African specimens including eight Welwitsch gatherings which, according to Robinson (1959), are plants with immature spikelets. One of these is the type of *K. welwitschii* Ridley. In 1901, Clarke reorganised *K. triceps* var. *ciliata* leaving the Welwitsch gatherings in that variety but transferring the remaining specimens to *K. controversa* var. *subexalata* C. B. Clarke. The only difference between these two groups of specimens was the presence, in the latter, of a very narrow wing on the keel of the glume. No measurements were given but the varietal epithet suggests it was a very narrow wing. The Welwitsch gatherings remaining in *K. triceps* var. *ciliata* were immature and this is significant for in the present study it was found that wing width was a factor of the age of the spikelets.

Thus, the two varieties cannot be upheld but must be regarded as one taxon. Present studies show that the difference between this taxon and *K. triceps* are real and of sufficient significance to warrant specific recognition, however it cannot be assigned to *K. controversa* as they are quite distinct from this rather doubtful species. *K. welwitschii* Ridley is the oldest valid name and is consequently applied to this taxon. This species is distinguished from other tufted species by its pale green multiple heads of sessile spikes, and the presence of 2 (or 1) stamens.

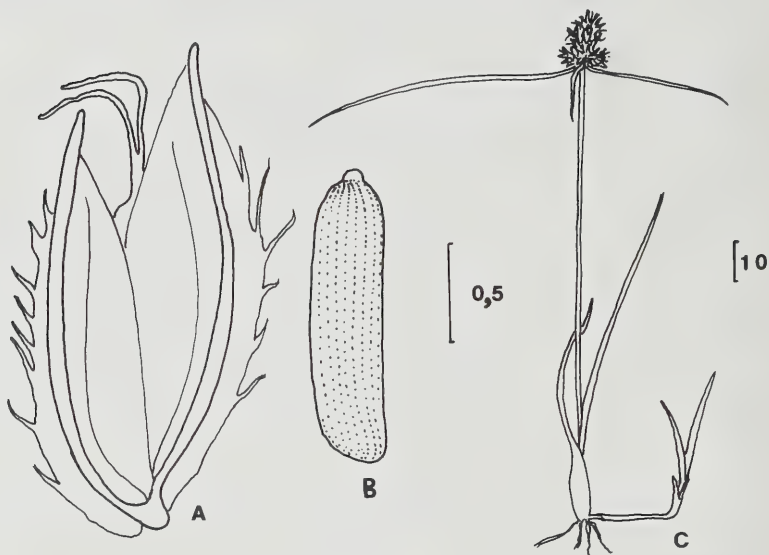


FIG. 7

A. Spikelet of *K. welwitschii* with two fertile winged glumes (lower prophyll and bract removed). B. Slender elongated nutlet removed from spikelet. C. Plant with slender stolon terminating in a new shoot. All scales in millimetres.

6. *K. odorata* Vahl, Enum. Pl 2: 382 (1806); Nees, Linnaea 9: 286 (1834); Kunth, Enum. Pl. 2: 132 (1837); Boeck., Linnaea 35: 410 (1868); C. B. Clarke, Kew Bull. Add. Ser. 8: 93 (1908); Hutchinson in Hutchinson and Dalziel, Flora W. Trop. Afr. 11, 2: 487 (1936); Hooper in Hepper, Flora W. Trop. Afr. 2: 304 (1972). Type: Habitat in Americo meridional v. Rohr. Richard (not traced)

Cyperus sesquiflorus (Torr.) Mattf. and Kükenth. in Engler, Pflanzenr. 4, 20: 591 (1936).

C. sesquiflorus var. *cylindricus* (Nees) Kükenth. in Engler, Pflanzenr. 4, 20: 592 (1936).

K. cylindrica Nees in Wight, Contrib. Bot. India: 91 (1834) and Linnaea 9: 286 (1934); Kunth, Enum. Pl. 2: 133 (1837); Boeck., Linnaea 35: 415 (1868); C. B. Clarke in Hooker f., Fl. Brit. India 6: 588 (1893); in Durand and Schinz, Conspect. Fl. Afr. 5: 528 (1895), in Thiselton-Dyer, Flora Cap. 7: 153 (1897), in Thiselton-Dyer, Flora Trop. Afr. 8: 282 (1901) and in Kew Bull. Add. Ser. 8: 93 (1908); Medley Wood, in Trans. S.A. Phil. Soc. 17, 2: 250 (1908). Type: India, herb. Royle no. 39 (LIV, holo).

K. triceps Rottb. var. *obtusiflora* Boeck., Linnaea 414 (1868).

Cyperus triceps var. *obtusiflorus* (Boeck.) Kükenth., in Engler, Pflanzenr. 4, 20: 579 (1936).

Roots fibrous. *Plants* tufted or forming short row of old sheathed stem-bases. *Culms* up to 540 mm tall, triangular, ridged and furrowed, glabrous, scarcely thickened at base. *Leaves* many, tufted at base of culm, half length of culms; sheaths short, brown; blade 2–4 mm wide, margins and keels scabrid. *Inflorescence* of 1–3 dense, white spikes; central cylindric, 8–16 mm long, 5–7 mm wide; lateral small, globose to cylindric. *Bracts* 3–4, leaflike, longest up to 93 mm long. *Spikelets* many, 2.47–2.52 mm long, broadly ovate in outline, tapering to acute apex, 1- (rarely 2)-flowered, fertile glumes 2, almost equal, lower 9-nerved, upper 5–7-nerved, sometimes enclosing third reduced hyaline glume; keel wingless, smooth or with 1–2 hairs, green, keel of lower glume slightly excurrent into mucro. *Anthers* 2. *Style* short, exceeded in length by style branches. *Nut* broadly obovoid, apex truncate, $\frac{2}{3}$ length of spikelet, yellow to red-brown, later black.

TRANSVAAL—2330 (Tzaneen): Westfalia Estate (-CA), Scheepers 17 (PRE). —2430 (Pilgrims Rest): Mariepskop district (-DB), van der Schijff 4946 (PRE).

NATAL—2830 (Dundee): 3 miles N of Kranskop (-DC), Getliffe 212 (NU).

—2831 (Nkandhla): Shongweni (-AA), Ross 773 (NU); Ngoya Reserve (-DC), Getliffe 216 (NU); Mtunzini "Hamewith" (-DD), Mogg 4428, 4522 (PRE).

—2930 (Pietermaritzburg): Burdons Farm, Karkloof (-AC), Wells 1089 (NU); "The Dargle", Getliffe 179 (NU); 3 miles up Curry's Post Road from Balgowan, Downing s.n. (NU); "The Start", Getliffe 203 (UN); "Rosebank", Durban Road, Greytown (-BA), Getliffe 195 (NU); Ahren, Mowbray, Fisher 953 (NU, PRE); Hermannsburg, vlei near school (-BB), Getliffe 172 (NU); Noodsberg Road, past Montebello turnoff (-BD), Getliffe 1658 (NU); Kings Cliff, Noodsberg Road, Getliffe 166 (NU); Town Bush Valley (-CB), Ward 117b (NU), Ross 721 (NU); Chase Valley, Getliffe 24 (NU), Ross 729 (NU); Portals Farm, Raisethorpe, Ram s.n. (NU); Pietermaritzburg Country Club, Ross 726 (NU); Thomas Moore School, Fields Hill, Getliffe 175 (NU); Pinetown Govt. Indian School, Getliffe 229 (NU).

—2931 (Stanger): Howard College (-CC), Getliffe 177 (NU).

CAPE—3129 (Port St. Johns): Port St. Johns above Tiger Flats (-DA), Galpin 2846 (PRE).

K. odorata is based on American material and *K. cylindrica* on Indian specimens. African gatherings have been assigned to both of these, but Kükenthal (1936) regarded them as two variations of *C. sesquiflorus*.

K. odorata was relegated to *C. sesquiflorus* var. *sesquiflorus* distinguished by its wider inflorescence and longer spikelets from the variety *cylindricus* (= *K. cylindrica* Nees).

Particular attention was therefore paid to these two characters in a survey of African material, including Welwitsch gatherings cited by Kükenthal. All specimens seen had inflorescences well within the range of the type and the spikelet length ranged from 2,3 to 3,25 mm without any discontinuity into two groups. Doubts about the separation of the taxon into two varieties were confirmed when specimens seen by Kükenthal did not fit his delimitations. It is apparent that no purpose is served in splitting this variable material into two varieties; accordingly only *K. odorata* Vahl is upheld. This species is characteristic of grassland habitats and its distinctive cylindrical head, frequently subtended by two smaller globose heads makes it readily distinguishable from other grassland forms. The nuts ripen to glossy black and are visible through the glumes giving mature heads a mottled appearance.

7. *K. alata* Nees, Linnaea 9: 281 (1834), Linnaea 10: 139 (1835–36); Kunth, Enum. Pl. 2: 136 (1837); Steud., Synops. Cyp. 69 (1855); Boeck, Linnaea 35: 430 (1868). Type: locis humidis arenosis ad “Koegakammaklog” et flumen Zwartkopsrivier alt II, Ecklon 883. (S, iso.?!).

Kyllinga alba var. *alata* (Nees) C. B. Clarke in Durand and Schinz, Consp. Fl. Afr. 5: 526 (1895), in Thiselton-Dyer, Flora Trop. Afr. 8:272 (1901); Burtt Davy and Pott-Leendertz, Ann. Trans. Mus. 132 (1912); Phillips, Ann. S.A. Mus. 16: 318 (1917); Schonland, Mem. bot. Surv. S. Afr. 3: 19, t. 1 (1922).

Cyperus alatus (Nees) F. Muell., Fragm. 8: 272 (1874); Kükenth. in Engler. Pflanzenr. 4, 20: 611 (1936).

Plants tufted, forming a short row of sheathed stem-bases, sheaths brown, tough, fibrous. *Culms* frequently, but not invariably, ciliate-pubescent below inflorescence. *Leaves* numerous, flaccid, generally more than half length of culm; *sheaths* less than $\frac{1}{3}$ length of culm, blade up to 5 mm wide, margin and keel scabrid, especially in young leaves. *Inflorescence* a single ovate to globose spike, rarely 2 additional lateral peduncled spikes [Getliffe 305 (NU).], golden-green. *Bracts* 3–4, occasionally reduced to 2. *Spikelets* many, approximately 6 mm long, ovate-lanceolate in outline, fertile glumes 2, almost equal, subtending 2 bisexual florets or upper male, both keels green, excurrent into long slender mucros, lower 0,5–1,2 mm (av. 0,87 mm) upper 0,27–1,04 mm (av. 0,67 mm). Wing narrow in young

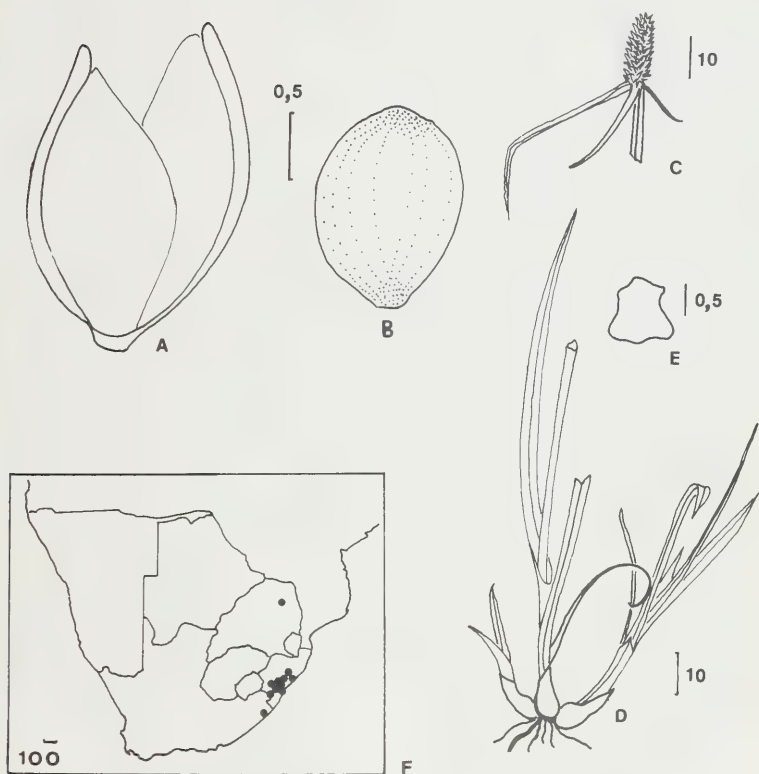


FIG. 8

Morphology and distribution of *K. odorata*. A. Spikelet with lower empty glumes removed. B. Large young golden fruitlet before maturing to black. C. Cylindrical inflorescence. D. Basal portion of leafy shoots with swollen stem-bases in cluster. E. Cross-sectional outline of culm. F. Distribution in southern Africa. Figure scales in millimetres: map scales in kilometres.

specimens, up to 0.85 mm wide in older, ciliate, golden-green. *Stamens* 3. *Style* shorter than style branches. *Nut* 1 or 2, obovoid, yellow, turning red-brown when mature.

S.W.A.—2116 (Okahandja): Grootfontein District, Okahandja (-DD), *Bradfield* 137 (PRE).

TRANSVAAL—2529 (Witbank): Middelburg (-CD), *Gower s.n.* sub PRE 29308 (PRE); *van der Merwe M.B.* 07 (PRE).

—2530 (Lydenburg): Belfast (-CA), *Leendertz* 9211, 9566 (PRE).

- 2626 (Klerksdorp): Hakboslaagte (-AC), *Kinges 1521* (PRE).
 —2628 (Johannesburg): Frankenwald (-AA), *van Rensburg s.n.* (-AD), *Leendertz 8011* (PRE).
 —2629 (Bethal): Ermelo (-DB), *Collins 12223* (PRE).
 ORANGE FREE STATE—2926 (Bloemfontein): near racecourse, Bloemfontein (-AA), *Potts 3002* (NU).
 NATAL—2632 (Bela Vista): 3,2 km from Kosi Nature Reserve (-DD), *Edward 2570* (PRE).
 —2732 (Umbombo): Mbaswana (-BC), *Michelmores 28* (PRE).
 —2832 (Mtubatuba): Hlabisa district, Charters Creek (-AB), *Ward 2776* (NH, PRE).
 —2929 (Underberg): Mooi River, Meteor Ridge (-BB), *Mogg 7066* (PRE).
 —2930 (Pietermaritzburg): The Dargle (-AC), *Getliffe 190* (NU); Fawn Leas (-BC), *Getliffe 169* (NU).
 —2931 (Stanger): Durban flats (-CC), *Medley Wood 4014* (NH); Wentworth, Bluff, *Getliffe 305* (NU), *Getliffe 1008* (J).
 —3029 (Kokstad): Harding District, Bedford Farm (-DB), *Lennox s.n.* (NU).
 CAPE—3029 (Kokstad): Bizana (-DD), *Strey 4336* (PRE).
 —3125 (Steynsburg): Steynsburg (-BD), *Acocks 13527* (PRE); Maraisburg district near Hofmeyer (-DB), *Acocks 16333* (PRE).
 —3227 (Stutterheim): Toise River (-DA), *Hilner 529* (PRE).
 —3228 (Butterworth): Kei Mouth (-CB), *Flanagan 927* (PRE).
 —3326 (Grahamstown): Port Alfred (-DB), *Potts 226* (BLFU).
 —3421 (Riversdale): Riversdale (-AB), *Muir 3586* (PRE).
 —3423 (Knysna): Knysna (-AA), *Breyer 23639* (PRE).

K. alata, described as a new species by Nees (1834), was relegated to a variety of *K. alba* by Clarke (1897 and 1901). Clarke used colour of glumes, width of wing on the glume and pubescence of culms to distinguish these taxa but did not mention the difference in mucro length and shape to which Nees (1935–36) drew attention.

Colour is reliable in the field where the golden spikelets of *K. alata* are conspicuously different from the white heads of *K. alba*, but in herbarium material is not always well preserved. Wing width varies with age, but is a reliable character in mature specimens, and pubescence of culms, particularly immediately below the inflorescence, is useful. Though some variation can be expected in *K. alata* in this character, no specimen *K. alba* was seen to be pubescent. While colour, wing width and pubescence may not be diagnostic when used separately, these characters used in combination separate *K. alata* from *K. alba*. Mucro length is, however, a very useful diagnostic character. Using a sample of twenty specimens from each taxon from the entire range of distribution, it was established that the presence of two long, curved mucros per spikelet of *K. alata* was a consistent characteristic and contrasted with the single (lower), straight mucro of *K. alba*.

K. alata is restricted to a southern African distribution while *K. alba* is also found in tropical Africa.

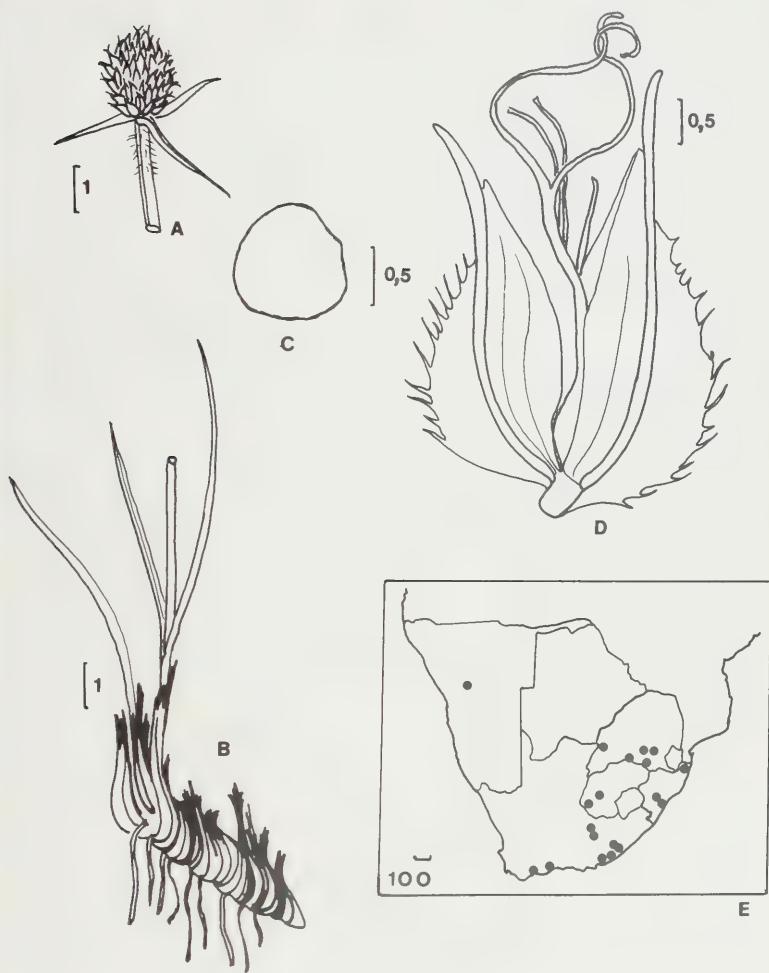


FIG. 9

Morphology and distribution of *K. alata*. A. Terminal spike subtended by short bracts, on a ciliate culm. B. Stem-bases clothed in fibrous sheaths. C. Cross-sectional outline of culm. D. Fertile winged glumes enclosing single nutlet. E. Distribution of the species in southern Africa. Figure scales in millimetres; map scale in kilometres.

8. *K. alba* Nees, *Linnaea* **10**: 140 (1836–36); Kunth, *Enum. Pl.* **2**: 136 (1837), *Ridl. Trans. Linn. Soc. Ser. 2*, **2**: 147 (1884); Clarke in Durand and Schinz, *Conspect. Fl. Afr.* **5**: 526 (1895), in Thiselton-Dyer, *Flora Cap.* **7**: 151 (1897), in Thiselton-Dyer, *Flora Trop. Afr.* **8**: 271 (1901), and *Kew Bull. Addit. Ser.* **8**: 93 (1908), Burt Davy and Pott-Leendertz, *Ann. Tvl. Mus.* **132** (1912); Phillips, *Ann. of S.A. Mus.* **16**: 318 (1917); Dyer, *Rec. of Alb. Mus.* **3**: 476 (1927); Schonland, *S. Afr. Cyp.* **19** (1922); Brain, *Proc. Rhod. Sc. Assoc.* **33**: 78 (1934). Type: South Africa "in utroque latere fluminis 'der zwarte Keyrivier' dicti alt III" Ecklon (S?, holo.).

Kyllinga cristata Kunth, *Enum. Pl.*: 136 (1837).

Kyllinga nigritana C. B. Clarke, in Thiselton-Dyer, *Fl. Trop. Afr.* **8**: 272 (1902).

K. alba Nees var. *nigritana* (C.B. Cl.) Podlech, *Mitt. Staatssamml. Münch.* **3**: (1960).

Cyperus cristatus (Kunth) Mattf. & Kükenth. in Engler, *Pflanzenr.* **4**, 20: 609 (1936).

Cyperus cristatus (Kunth) Mattf. & Kükenth. var. *nigritanus* (C.B. Cl.) Kükenth. in Engler, *Pflanzenr.* **4**, 20: 610 (1936).

Kyllinga alata (Nees) Hutchinson in Hutchinson and Dalziel, *Flora W. Trop. Afr.* **1**, 2: 487 (1936).

Kyllinga cristatus var. *exalatus* Merxm., *Proc. and Trans. of Rhod. Sc. Assoc.* **43**: 75 (1951).

Cyperus cristatus var. *exalatus* Merxm. *Trans. Rhod. Sc. Assoc.* **43**: 80 (1951).

K. alba var. *exalata* (Merxm.) Podlech, *Mitt. Staatssamml. Münch.* **3**: 525 (1960).

Plants tufted or forming a short row of sheathed stem-bases; sheaths brown, tough, frequently fibrous. *Culms* up to 520 mm tall, triangular, glabrous or minutely scabrid below inflorescence. *Leaves* numerous, flaccid, generally more than half length of culm; *sheaths* less than $\frac{1}{3}$ length of leaf; *blade* up to 5 mm wide, margin and keel scabrid especially in young leaves. *Inflorescence* of 1 (rarely 3) spikes, dense, globose to broadly elliptic, up to 15 mm in diam., snow-white or tinged with green or discoloured by rusty streaks. *Bracts* 2–5, usually 3, patent, later pendent, up to 121 mm long. *Spikelets* numerous, up to 6.37 mm long, ovate-lanceolate in outline, fertile glumes 2–4, rarely more than 2 fully developed, subtending 2 florets, both bisexual or upper male, rarely 3 (2 bisexual, uppermost male); lower glume strongly 7–11-nerved, keel excurrent into straight mucro up to 0.86 mm long; upper 5-nerved, keel scarcely or not at all excurrent into mucro. *Wing* to keel variable, absent, narrow (approximately 0.04 mm) or wide (up to 1 mm), glabrous or ciliate, white. *Anthers* 3. *Style* exceeded in length by

style branches. *Nut* 1, rarely 2, ellipsoid, shortly spiculate, half length of glume, golden, later red-brown to black.

S.W.A.—1713 (Swartbooisdrif): Okavango Territory, S of Omuramba (-AD), *de Winter* 3884 (PRE).

—1719 (Runtu): Vlei near Runtu (-DD), *Merxmüller & Giess* 2135 (M).

—1729 (Sambio): East of Masare Camp (-CC), *de Winter & Wiss* 4100 (M, PRE).

—1917 (Tsumeb): 50 miles W of Grootfontein (-BC), *Schoenfelder* 35 (PRE).

—1918 (Grootfontein): Grootfontein (-CA), *Story* 6131 (PRE).

—2115 (Karibib): on way to Red Koppies at Karibib (-DD), *Kinges* 3193 (M, PRE).

—2217 (Windhoek): Farm Otjisewa (-CA?) *Wiss* 755 (M); Farm Onduno (-CA?) *Kinges* 4959 (M).

TRANSVAAL—2231 (Pafurie): Kruger National Park S.E. of Punda Milia (-CA), *Schieben* 9525 (M).

—2329 (Pietersburg): Pietersburg (-CD), *Codd and Dyer* 9157 (PRE); Haennertzburg (-DD), *Pott* 4751 (PRE).

—2330 (Tzaneen): Woodbush (-CC), *Mogg* 14716 (PRE).

—2427 (Thabazimbi): Rustenburg district, Vlakfontein (-AB), *Liebenberg* 158 (PRE).

—2428 (Nylstroom): Nylstroom (-CB), *van Dam s.n.* (PRE); Naboomspruit (-DA), *Galpin* M375 (PRE).

—2429 (Zebediela): Schoonoord, Lydenburg district, (-DD) *Mogg and Barnard* 794 (PRE).

—2430 (Pilgrims Rest): Pilgrims Rest (-DD), *de Winter and Codd* 539 (PRE).

—2431 (Acornhoek): Skukuza (-DC), *de Winter and Codd* 538 (PRE).

—2527 (Rustenburg): Rustenburg (-CA), *Lanham* 25 (PRE).

—2528 (Pretoria): Onderstepoort (-CA), *Teiler* 14805 (PRE); Pretoria, *Leendertz* 7211 (PRE); do. *Stent* 573 (PRE); do. *Bryant* E2 (PRE); do. Sloff's Cutting, *Smith* 177, 822 and 861 (PRE); Bronkhorstspuit (-DC), *Pepton* 4703 (PRE).

—2531 (Komatipoort): Pretoriuskop, Kruger National Park (-AB), *van der Schijff* 1071 (PRE).

—2626 (Klerksdorp): Lichtenburg district, Hakbaslaagte (-AC), *Kinges* 1520 (PRE, M).

—2627 (Potchefstroom): Welverdiend (-AD), *Louw* 98 (PRE); Potchefstroom (-CA), *Louw* 1167 (PRE).

—2628 (Johannesburg): Turffontein (-AA), *Bryant* D50 (PRE); Heidelberg (-AD), *Leendertz* 8012 (PRE).

—2725 (Bloemhof): Christiana (-CC), *Theron* 432 (PRE); Bloemhof (-DA), *Burt* *Davy* 11242, 12838, 14438 (PRE), *van der Merwe* 58 (PRE).

ORANGE FREE STATE—2727 (Kroonstad): Kroonstad (-CA), *Pont* 495 (BLFU, PRE).

—2926 (Bloemfontein): Bloemfontein (-AA), *Potts* 407 (NU), *Potts* 3031 (NU, PRE), *Potts* 1326 (NU), *Potts* 3006, 3009, 3022 (BLFU); Channon (-AB), *Hatchard* 7328 (BLFU).

—3025 (Colesburg): Trompsburg (-BB), *Potts s.n.* (BLFU).

—3027 (Lady Grey): Pan near Quaggafontein (-AC), *Potts* 3006 (BLFU).

SWAZILAND—2531 (Komatipoort): Hlatikulu district, Havelock Concession (-CC), *Saltmarsh* 1021 (PRE).

—2631 (Mbabane): Forbes Reef Swamp (-AA), *Compton* 30564 (PRE, HSS); Komati Pass, Mbabane (-AC), *Compton* 31048 (HSS); Hlatikulu, (-CD), *Stewart s.n.* (PRE).

NATAL—2632 (Bela Vista): Ndumu Hill (-CD), Ross 675 (NU); Ndumu Game Reserve, Ross 685, 693 (NU).

—2732 (Ubombo): Summit of Lebombo Mountains (-AA, -AC), Getliffe 178 (NU); Ubombo Village (-CA), Ward 1656 (NPGF, NU, PRE), Getliffe 162 (NU).

—2929 (Underberg): Warley Common (-BB), Mogg 7248 (PRE).

LESOTHO—2828 (Bethlehem): Caledon River, Burke 202 (PRE), Dieterlen 334 (PRE, NH).

CAPE—2624 (Vryburg): Vryburg (-DC), Sharpe 7420 (PRE); do. Mogg 8170 (PRE); Vryburg and Tiger Kloof, Brueckner 2831 (PRE); 60 miles from Vryburg (Farm Palmyra), Rodin 3598 (PRE).

—2723 (Kuruman): Kuruman, Esperanza (-AD), Esterhuysen 2143 (PRE).

—2823 (Griekwastad): Postmasburg (-AC), Leistner 1662 (PRE); Daniel's Kuil (BA), Esterhuysen s.n. (PRE).

—2824 (Kimberley): Kimberley (-DB), Moran s.n. (PRE).

K. alba is a widespread tropical and temperate species with which have been associated several allies. In the course of this study, each of these allied taxa was compared with *K. alba*.

Closely allied to *K. alba*, according to many authors (Clarke, 1901; Brain, 1934; Kükenthal, 1936 and Robinson, 1959), is *K. controversa* Steud. The original descriptions of these two species differ only in the statement that *K. controversa* has two stamens but Clarke (1901) remarked on the pale brown inflorescence, ciliate keelar wing and short spikelets. Studies of wing width have revealed considerable variation within *K. alba* and considerable overlap in range of this and allied taxa (Figure 10). This does not support the separation of *K. alba* and *K. controversa* on the basis of wing width. All specimens examined, whether tropical or southern African, had three stamens. Nor does the spikelet length, with ranges of 3,08 (av. 3,72) – 5,40 mm for *K. alba*, and 3,67 (av. 4,3) – 6,25 mm for *K. controversa* separate these two. *K. controversa* has therefore been placed in synonymy with *K. alba*.

K. nigriflora C. B. Clarke was distinguished by its pale cinnamon-coloured, broadly ovate winged spikelets. Podlech (1960) regarded it as a variety of *K. alba*. Comparison of specimens seen by Podlech with authentic *K. alba* specimens, suggests that the colour difference was the result of rusty streaks or dots similar to those found in gatherings of *K. alba* from dry localities (Moran 1918, Sharpe 7420, Rodin 3598). In every other respect, these two taxa appear identical. Similarly, *K. alba* var. *exalata* is not upheld in view of the variation in wing width over the range of distribution and with age.

Robinson (1959) suggested that *K. cartilaginea* Schum. was closely allied to *K. alba*. Kükenthal (1936) maintains it as a distinct species. Further study of this tropical species is necessary, but two characteristics suggest it is a separate species: the presence of an extremely long mucro on the lower fertile glume giving the heads "a prickly look" (Robinson, 1959) and the very dis-

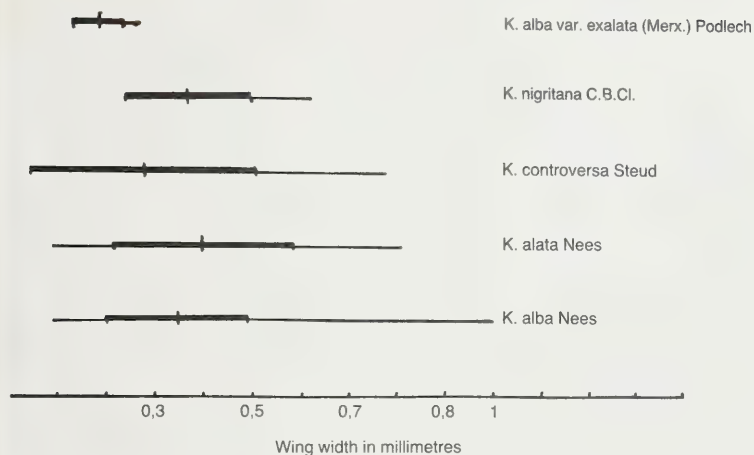


FIG. 10

Mean wing width (M), standard deviation from the mean (heavy line) and range of wing width (narrow line) from representative samples of *K. alba* and associated taxa.

tinct rhizome morphology as evident in *Napper 1371* (Herb. EARO) in which aerial shoots are 30–40 mm apart on an elongated rhizome.

K. alba is therefore recognized as a complex, variable species with tropical affinities. It is a distinctive tufted species with globose white spikes sometimes tinged with cinnamon in drier areas. It is unlikely to be confused with any other South African species.

As described above, it is distinguished from *K. cartilaginea* by rhizome characters. *K. platyphylla* Schum., collected rarely in Zimbabwe but frequently in Zambia and Tanzania, is similar but has broad flattened hemispherical heads composed of three confluent spikes clasped by 3–4 bracts.

9. ***K. brevifolia*** Rottb., Descr. et Icon. 13, t.4, fig. 3 (1773); Nees in Wight, Contrib. Bot. India 91 (1834); Künth, Enum. Pl. :130 (1837); Steud., Synops Cyper. 67 (1855); Boeck. in Linnaea 35: 424 (1868); p.p.; Clarke in Hooker, Fl. Brit. India 6: 588 (1893), in Durand and Schinz, Conspect. Fl. Afr. 5: 527 (1895), in Thiselton-Dyer Fl. Trop. Afr. 8: 273 (1901) and in Illustr. Cyp. t. I Fig. 1–4 (1909); Chermezon, Catal. Pl. Madag. 7 (1931), Barros, in Anal. Mus. argent. Cienc. Natur.: 136f.l.: 11 (1935) Hooper, in Hepper, Flora W.Trop.Afr. ed 2,3, 2:307 (1972). Type: India, *Koenig* (BM, holo.!, STB, iso., photostat seen).

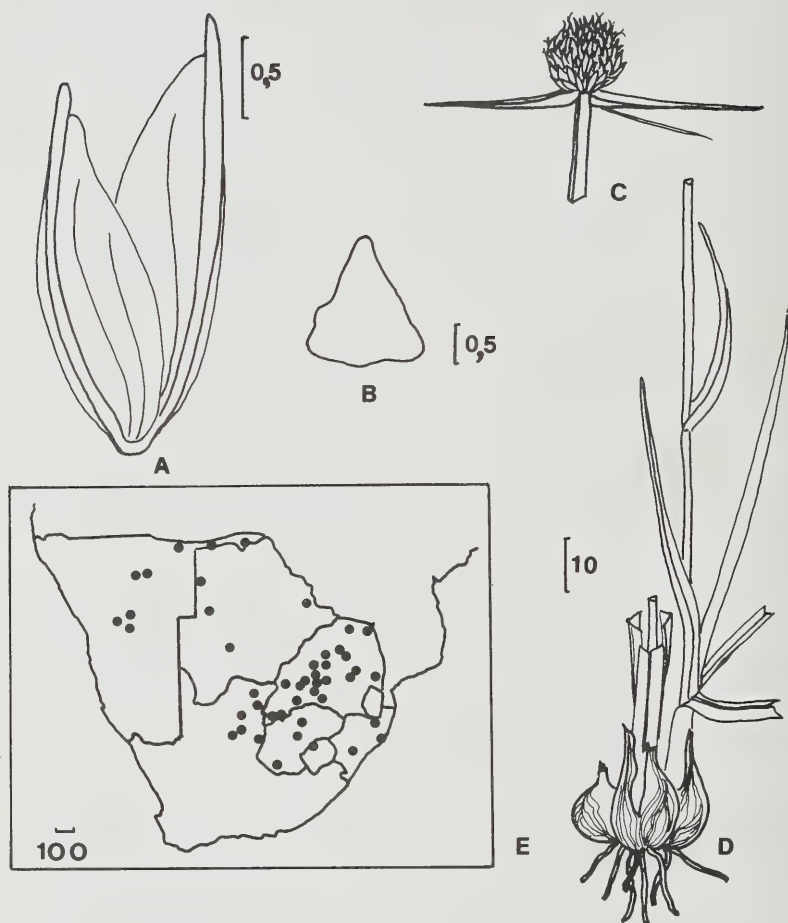


FIG. 11

Morphology and distribution of *K. alba*. A. Fertile glumes of spikelet with narrow wings on the keels. B. Cross-sectional outline of stem. C. Inflorescence. D. Group of stem-bases. E. Distribution of the species in southern Africa. Figure scales in millimetres; map scales in kilometres.

Cyperus brevifolius (Rottb.) Hassk., Kükenth., in Engler, Pflanzenr., 20:600 (1936).

K. cruciata Nees in Linnaea 9: 286 (1834), name only.

Rhizome slender (1–2½ mm diam.), elongate, white or greenish-white, covered with membranous, striate scales. *Culms* 5–30 mm apart, slender, 7–32 mm tall, triangular, glabrous, bases unthickened. *Leaves* few, equaling or shorter than culms; sheaths membranous, lower 1–2 leafless or briefly laminate; blades 1–3 mm wide, margins and keel scabrid, shortly acuminate. *Bracts* 3–4, long, erect, later spreading. *Inflorescence* of 1 spike (rarely 2 or 3), ovoid to ellipsoid, greenish-white, dense. *Spikelets* numerous, tightly packed, elliptic in outline, 2–3.5 mm long; floret 1, bisexual, rarely 2, lower bisexual, upper male. *Fertile glumes* 2, membranous, transparent white, lower 7-nerved, upper 3–5-nerved, keel green, scabrid, excurrent into acute recurved mucro (0.2–0.45 mm). *Stamens* 1 per floret. *Style* short, far exceeded in length by style branches. *Nut* ½ length of glume; broadly obovate, yellow.

NATAL—2930 (Pietermaritzburg): Vlei in Pietermaritzburg (-CB), *Thurgood s.n.* (NU); Chase Valley, *Getliffe* 23 (NU); Wyllie Park, *Ross* 357, 358 (NU); University of Natal, *Getliffe* 191, 228 (NU); Botanical Gardens, *Ross* 1266 (NU); Golf Road, Pietermaritzburg, *Ross* 1267 (NU); King Edward Avenue, *Getliffe* 998, 999 (J); Thomas Moore School, Pinetown (-DD), *Getliffe* 1003 (J); Edgewood Training College, Pinetown, *Getliffe* 1007 (J).

—2931 (Stanger): Jameson Park (-CC), *Hilliard s.n.* (NU); Windsor Park Golf Course, *Getliffe* 976 (J).

Although it appears, as *K. erecta*, in Henderson and Anderson (1966) as a weed in South Africa, there has been no other record of this species from southern Africa until the present study. It has, however, been well recorded for west tropical Africa (Clarke, 1901; Hutchinson, 1936; Hooper, 1972b). The possibility of this frequent weed of lawns being an introduction cannot be dismissed.

There appears to be some confusion in the older descriptions over the stamen number. Linnaeus in his *Species Plantarum* placed it among plants with three stamens, Kunth (1837) agreed but Barros (1935) working on South American material recorded one stamen only per floret. Kükenthall (1936) gave a range of 1–3. Either this is an extremely variable taxon, or several distinct taxa have been confused in the description. South African specimens have but a single stamen per floret.

Apart from this distinctive feature, it is recognized by its slender white rhizomes (without the striking red-brown scales of *K. intricata*) and its greenish-white ovoid to ellipsoid spikes. It cannot be confused with *K. erecta* which has a fleshy rhizome and contiguous, bulbous-based stems.

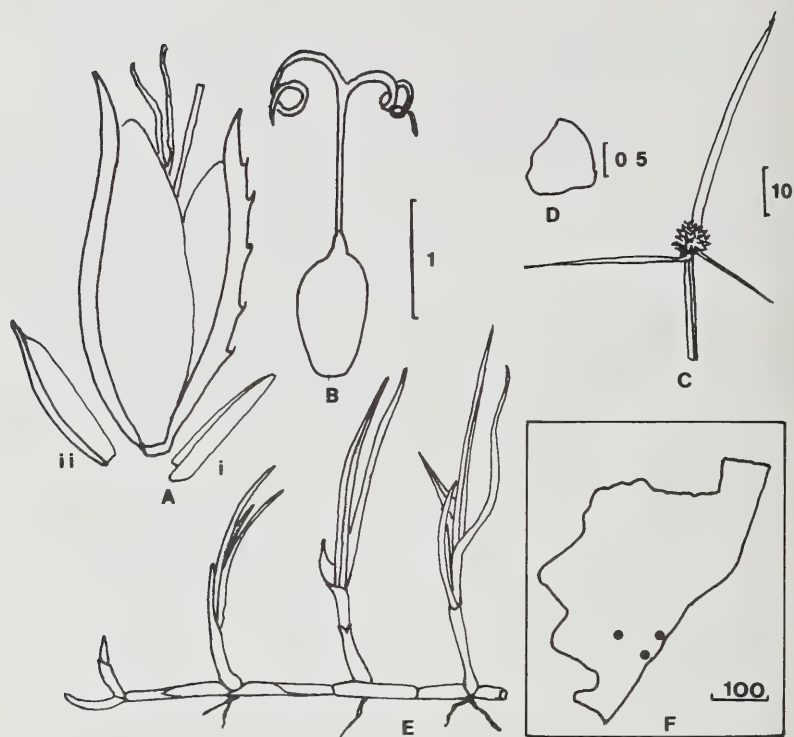


FIG. 12

Morphology and distribution of *K. brevifolia*. A. Spikelet with lower sterile bract (i); and prophyll or empty glume (ii) and two glumes enclosing 1 floret with a single stamen. B. Young nutlet. C. Inflorescence with one erect bract and two smaller spreading bracts. D. Cross-sectional outline of stem. E. Portion of slender elongated rhizome. F. Distribution of the species in Natal. Figure scales in millimetres: map scale in kilometres.

10. *K. elatior* Kunth, Enum. Pl. 2: 135 (1837); Steud., Synops. Cyper. 69 (1855); Boeck in Linnaea 35: 422 (1868); C. B. Clarke, in Durand and Schinz, Conspect. Fl. Afr. 5: 528 (1895), in Thiselton-Dyer, Fl. Cap. 7: 153 (1897), in Thiselton-Dyer, Flora Trop. Afr. 8: 275 (1901) and in Kew Bull. Add. Ser. 8: 93 (1908); Medley Wood in Trans. S.A. Phil. Soc. 2: 250 (1908); Chermexon, Catal. Pl. Madag. 7 (1931); Hooper in Hepper, Flora W. Trop. Afr. ed 2, 3, 2:307 (1972). Type: South Africa, Pondoland. *Drège* 4384 (B, holo., possibly destroyed; P, iso.).

Cyperus aromaticus (Ridl.) Mattf. et Kükenth. var. *elator* (Kunth) Kükenth. in Engler, Pflanzenr. 4, 20:582 (1936).

Roots thick. *Rhizome* elongated, horizontal, slender (2–3 mm diam.), pliable, covered with acuminate, striate scales with transparent membranous margins. *Stem-bases* scarcely thickened, covered with scales and pinkish-brown sheaths. *Culms* 150–600 mm tall, triangular, distant, 3–22 mm apart, average 17 mm apart, glabrous. *Leaves* few, shorter than culms, lower leaves reduced to sheaths, upper 2–4 sheaths laminate; sheaths membranous, pinkish-brown, frequently transversely wrinkled below mouth; blades 2–6 mm wide, scabrid on margins and keels and on lower leaf surface, particularly near tip. *Bracts* 4–6, spaced at short intervals below inflorescence, up to 290 mm long, spreading at right angles to culms. *Inflorescence* of 3–1 green spikes, dense; central spike cylindric, 7–20 mm long, 5–13 mm wide; lateral smaller. *Spikelets* numerous 2.7–4.5 mm long, ovate-lanceolate in outline; fertile glumes 3; lower glume 7-nerved, subtending bisexual floret, middle 5-nerved, subtending male (rarely bisexual) floret; keels green, wingless, glabrous or with 1–4 hairs, excurrent into slender, acuminate, recurved mucro, 0.28–0.59 mm long. *Stamens* 3, anthers linear, connective slightly produced and red. *Style* greatly exceeded in length by branches. *Nut* (rarely 2), obovoid, approximately 1 mm long, red-brown, later black.

NATAL—2831 (Nkandhla): Ngoye Forest Reserve, streambank (-DC), *Getliffe* 215 (NU); Qwesqweqneqno, Ngoye Forest Reserve, *Getliffe* 217 (NU); Forest Guard Hut, Ngoye Forest Reserve, *Getliffe* 220 (NU); Mtunzini, Port Durnford Forester's Office (-DD), *Getliffe* 214 (NU).

—2832 (Mtubatuba): Richards Bay (-CC), *Ward* 714 (NU); do. *Getliffe* 60 (NU).

—2930 (Pietermaritzburg): Lions River district, "The Start", Karkloof (-AD), *Getliffe* 205 (NU); Town Bush Valley, Pietermaritzburg (-CB), *Ward* 118 (NU); do. *Getliffe* 196 (NU); Table Mountain, *Killick* 375 (NU, PRE); Chase Valley, Pietermaritzburg, *Jolliffe* 34 (NU); do. *Wilson* 11 (NU); do. *Getliffe* 25 (NU); do. *Ross* 728 (NU); Enon Estate, Richmond (-CD), *Getliffe* 165 (NU); Nagle Dam (-DA), *Wells* 1021 (NU); Ichanga (-DC), *Armour s.n.* (NU); Isipingo Flats (-DD), *Ward* 4961 (NU); Wentworth, relict of Bayhead Swamps (-DD), *Ward* 4971 (NU).

—2931 (Stanger): Farm Waterbosch, Stanger (-AD), *Bodhoo s.n.* (NU); Stanger Secondary School, *Getliffe* 226 (NU); Inanda district, Mount Edgecombe (-CA), *McMartin* 9 (NU); do. *Getliffe* 201 (NU);

—3030 (Port Shepstone): Isipingo Beach (-BB), *Ward* 4065 (NU); do. *Ward* 4968 (NU); Sezeta River (-BC), *Getliffe* 31 (NU); Glenmore, Port Shepstone district (-CD), *Anderson* 55 (PRE).

CAPE—3129 (Port St. Johns): Port St. Johns district (-DA), *Schonland* 4162 (PRE).

—3227 (Stutterheim): NW of Zele P.O., King Williamstown (-CD), *Acocks* 20279 (PRE, SRGH).

This elegant species with long horizontal bracts and elongate slender rhizomes bearing culms at wide intervals occurs in damp shady situations where

it may form dense stands. The inflorescence is a cylindrical spike borne on acutely three-angled stems. Not only is the rhizome fragrant but the aerial parts are delicately lemon-scented when bruised. A mat, possibly for carrying maize meal and known as "isitebe", is made from these culms (Medley Wood, 1908).

K. elatior is unlikely to be confused with any other South African species but the description in Brain (1934) is misleading being based on an incorrectly named gathering of *K. melanosperma*. The long bracts and elongate rhizome are reliable features distinguishing these species; similarly the congested rhizome of *K. polyphylla* and its composite inflorescence of globose spikes distinguishes this from *K. elatior*.

11. *K. intricata* Chermezon, in Bull. Mus. Hist. Nat (Paris) **25**: 211 (1919); Catal. Pl. Madag. 8 (1931); Podlech in Prodr. Fl. Südwestafr. **165**:31 (1967). Type: Madagascar, *Hildebrandt* 3788 (K, holo.).

K. erecta var. *intricata* C. B. Clarke in Durand and Schinz, Conspect. Fl. Afr. **5**: 529 (1895).

Cyperus erectus (Schum.) Mattf. and Küenth. var. *intricatus* (C. B. Clarke) Küenth. in Engler, Pflanzenr. **4** (20): 590 (1936).

Rhizome elongate, slender, 1–2 mm diam., horizontal, covered with loose, red-brown scales. *Culms* 5–(15)–30 mm apart, bases not thickened. *Leaves* 2–9 per culm, shorter than culms. *Bracts* 3, lowest erect, later reflexed. *Inflorescence* 1 globose spike 4–8 mm wide, compact golden-buff. *Spikelets* many, ovate—lanceolate in outline, 2–4 (av. 2.97) mm long. *Fertile glumes* 2 or 3, briefly mucronate, lower mucro av. 0.18 mm, upper 0.13 mm. *Style* shorter than branches. *Nut* 1, less than half length of glume, ellipsoid to obovoid, yellow to black.

S.W.A.—1719 (Runtu): Okavango Reserve (-DD), *de Winter* 3744 (M, PRE). —1821 (Andara): Caprivi Zipfel, Andara (-AB), *Merxmüller & Giess* 1977 (M); E Caprivi (-AB?), *Killick & Leistner* 3034 (PRE).

TRANSVAAL—2528 (Pretoria): 15 km from Hammanskraal (-AD), *Kies* 374 (PRE); do. *Codd* 3512 (PRE).

NATAL—2931 (Stanger): Verulam (-CA), *Medley Wood* 1076 (NH).

K. intricata is a tropical species with limited distribution in South Africa. It is allied to *K. erecta* but its distinctive rhizome with elongated internodes and loose overlapping scales distinguish it from that species. The mucro length in *K. intricata* is distinctly shorter than that of *K. erecta*, spikelets are also smaller on an average but the ranges overlap making this less valuable than rhizome and mucro features.

12. *K. erecta* Schumach. in Schum. et Thon., Besk. Guin. Pl. 63 (1827); C. B. Clarke in Durand and Schinz, Conspect. Fl. Afr. **5**: 528 and in Thiselton-

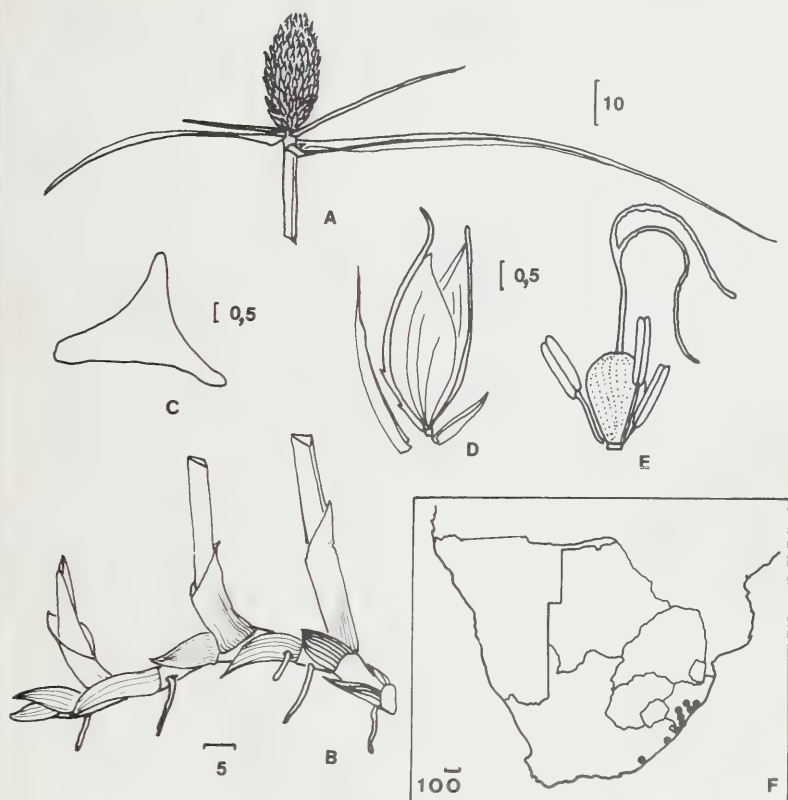


FIG. 13

Morphology and distribution of *K. elatior*. A. Inflorescence subtended by long spreading bracts. B. Robust elongated rhizome clothed in striate scales. C. Cross-sectional outline of culm. D. Spikelet with lower empty glumes (bracts and prophyll) and two fertile glumes. E. Floret from within fertile glumes. F. Distribution in southern Africa. Figure scales in millimetres; map scale in kilometres.

Dyer, *Flora Trop. Afr.* 8:274 (1901); Rendle, in *Catal. Afr. Pl. Welw.* 2: 105 (1899); Medley Wood, in *Trans. S.A. Phil. Soc.* 18, 2: 250 (1908); Schonland, in *Mem. bot. Surv. S. Afr.* 3: 20 t11 (1922); Chermezon, *Catal. Pl. Madag.* 7 (1931), Hutchinson in Hutchinson and Dalziel, *Flora W. Trop. Afr.* 2, 2: 487 (1936); Nelves and Baldwin, in *Amer. Journ. Bot.* 39: 389 (1952); Hooper in Hepper, *Flora W. Trop. Afr.* ed 2, 3, 2: 307 (1972).
Type: Guinea, *Isert and Thonning* (C).

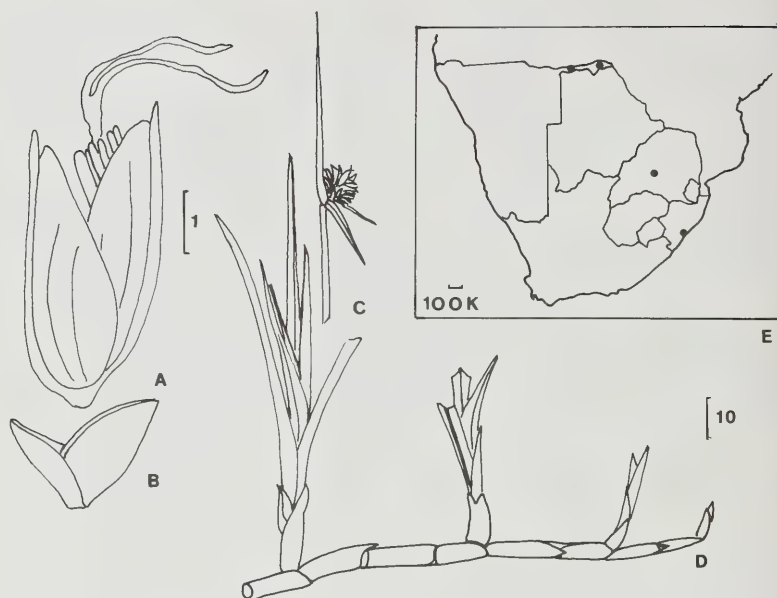


FIG. 14

Morphology and distribution of *K. intricata*. A. Spikelet including empty lower glumes (B). C. Inflorescence with one erect bract. D. Portion of rhizome clothed in loose brown scales. E. Distribution in southern Africa. Figure scales in millimetres: map scale in kilometres.

K. aurata Nees in *Linnaea* **10**: 139 (1935–36), Kunth, *Enum. Pl.* **2**: 137 (1837), Steud., *Synops Cyp.* 69 (1855), Boeck. in *Linnaea* **35**: 422 (1868), Ridl. in *Trans. Linn. Soc.* **2** ser. Bot. **2**: 146 (1884).

K. colorata Hutchinson, in Hutchinson and Dalziel, *Flora W. Trop. Afr.* **2**, **2**: 487 (1936) (non (L.) Druce).

Cyperus erectus (Schum.) Mattf. and Kükenth. in Engler, *Pflanzenr.* **4**, **20**: 588 (1936).

C. erectus var. *aurata* (Nees) Kükenth. in Engler, l.c. 589 (1936).

Rhizome moderately long, of bulbous stem-bases. internodes short, clothed in acuminate, red-brown, seldom overlapping, scales. *Culms* produced in uniseriate row, slender, triangular to rounded, glabrous, bases bulbous, thickened. *Leaves* few, shorter than culms; sheaths short, lowest 2–3 leafless, red-brown, blade flat, 2–3 mm wide, flaccid, acuminate. *Bracts* 3, lowest erect, later reflexed. *Inflorescence* of 1 spike, globose to ovoid, 4–8 mm wide, compact, greenish-yellow to red-golden. *Spikelets* many, ovate-

lanceolate in outline, 2–3 mm long, fertile glumes 2 or 3 golden, frequently rust-streaked, lowest prominently 7–9-nerved, subtending bisexual flower, middle 3–5-nerved, subtending male flower, sometimes enclosing reduced hyaline uppermost empty glumes, keels green when fresh, glabrous or with 1–2 scabrid hairs, excurrent into acute recurved mucro 0.2–0.5 mm long (average length of lower mucro 0.35 mm). *Style* exceeded in length by style branches. *Nut* 1, less than $\frac{1}{2}$ length of glume, ellipsoid to obovoid, yellow to black.

TRANSVAAL—2530 (Lydenburg): Machadodorp (-CB), *de Winter and Codd* 227 (PRE).

—2531 (Komatipoort): Pretoriuskop (-AB), *van der Schijf* 1999 (PRE).

—2626 (Klerksdorp): Hakboslaagte (-AC), *Kinges* 1648 (PRE).

—2627 (Potchefstroom): Potchefstroom district, Laerberg (-CA), *Theron* 686 (PRE); Potchefstroom, *Louw* 1216 (PRE).

—2628 (Johannesburg): Frankenwald (-AA), *Gilliland* 25059 (PRE).

—2629 (Bethal): Ermelo (-DB), *Leendertz* 10539 (PRE); Noodgedacht, *Potter* 1781 (PRE).

ORANGE FREE STATE—2828 (Bethlehem): Bethlehem (-AB), *Phillips* 3102 (PRE).

NATAL—2632 (Bela Vista): Ndumu Game Reserve (-CD); *Ross* 659, 687, 694 (NU).

—2732 (Ubombo): False Bay Park (-CD), *Ward* 4144 (PRE).

—2832 (Mtubatuba): Hluhluwe Game Reserve (-AA), *Ward* 1793 (NH, NPGF, NU, PRE); St. Lucia Park (-AD), *Dutton* 62 (NU).

—2930 (Pietermaritzburg): New Hanover, Fawnleas (-BC), *Getliffe* 170 (NU); Town Bush Valley (-CB), *Ward* 110 (NU); Oribi, *Evans* 17 (NU); Thomas Moore School (-DD), *Getliffe* 176 (NU).

—2931 (Stanger): Mount Edgecombe (-CA) *Most* 77 (NU).

CAPE—2624 (Vryburg): Moita, Mafikeng District (-BB), *Brueckner* 554 (PRE).

—3326 (Grahamstown): Grahamstown (-BC), *Daly & Sole* 202 (PRE); Trappes Valley, *Daly* 12934 (PRE); do. *Lubke* 88 (NU); Alexandria District near Whitney (-DA), *Archibald* 5068 (PRE).

—3327 (Peddie): between Core Rock and Gooda River (-BB), *Galpin* 7355 (PRE).

—3420 (Bredasdorp): Heidelberg (-BB), *Esterhuysen* 14455 (PRE).

Kyllinga erecta Schum. and *K. aurata* Nees were regarded as synonyms by Clarke (1897) and Schonland (1922), but Kükenthal recognized them as two varieties of *Cyperus erectus*. He distinguished the variety *aurata* by its golden to rust forms, shorter culms, narrower leaves and longer mucronate tips to the keel of the glumes.

Height of the plant cannot be regarded as diagnostic as it is so dependent upon environmental conditions and indeed *Dieterlen* 211 (which Kükenthal cites as the variety *aurata*) exceeds his 200 mm limit for *C. erectus* var. *auratus*. Leaf-width has been shown to be unreliable and no significant difference in mucro length could be detected.

In the more southerly collections the colour of the head appears to be prominently golden but in the absence of any clear-cut distinction it is proposed that *K. erecta* and *K. aurata* are conspecific.

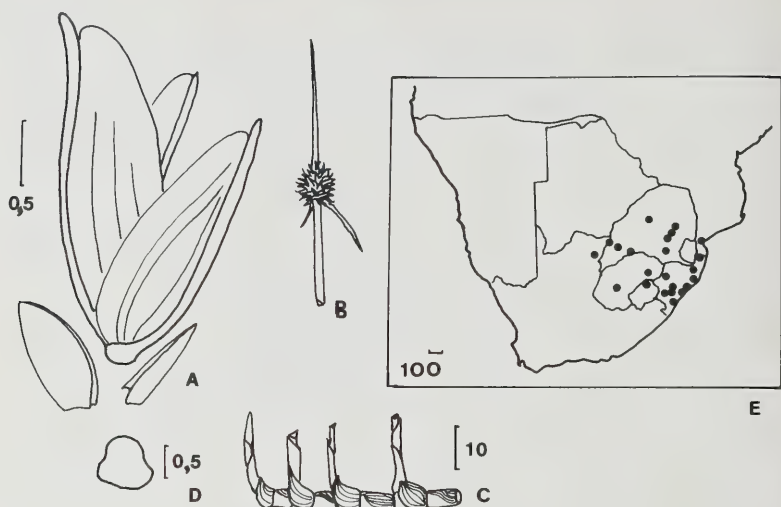


FIG. 15

Morphology and distribution of *K. erecta*. A. Whole spikelet. B. Inflorescence with erect bract. C. Rhizome comprising short swollen internodes with bulbous-based shoots not contiguous. D. Cross-sectional outline of culm. E. Distribution of species in southern Africa. Figure scales in millimetres: map scale in kilometres.

13. *K. melanosperma* Nees in Linnaea 9: 286 (1834) name only, in Wight, Contributions to the Bot. of India, 91 (1834); Kunth, Enum. Pl. 2: 131 (1837); Steud. Synops. Cyper. 67 (1855); Boeck. in Linnaea 35: 419 (1868); Oliver in Trans. Linn. Soc. 29: 166 (1875); C. B. Clarke, in Hooker Fl. Brit. India 6: 588 (1893), in Durand and Schinz, in Thiselton-Dyer, Flora Cap. 7: 153 (1897), in Thiselton-Dyer, Flora Trop. Afr. 8: 277 (1901) and in Bull. Misc. Inf. Add. Ser. 8: 93 (1908); Medley Wood, in Trans. S.A. Phil. Soc. 17, 2: 250 (1908); Burt Davy & Pott-Leendertz, in Ann. Trans. Mus. 132 (1912); Schonland in Mem. bot. Surv. S. Afr. 3: 20 (1922); Dyer, in Rec. Albany Mus. 470 (1927); Fourcade in Mem. bot. Surv. S. Africa 20: 85 (1941); Hooper in Hepper, Flora W. Trop. Afr. ed 2, 3, 2: 307 (1972). Type: India, Wight 1851 (K, holo.).

Cyperus melanospermus (Nees) Kükenth. in Engler, Pflanzenr. 4, 20: 583 (1936).

Roots thick. *Rhizome* horizontal, stout (4–8 mm diam.), congested (internodes 3–5 mm) covered with short red-brown, acuminate, imbricate scales with hyaline margins. *Stem-bases* bulbous-thickened, covered with cuspidate scales. *Culms* 150–1 000 mm tall, firm, triangular, glabrous, con-

gested, in uniseriate rows or massed in groups. *Leaves* few, lower leaves reduced to red-brown membranous sheaths, upper 2–4 sheaths shortly laminate; sheaths long, mouth of sheath often membranous and transversely wrinkled; blade 3–4 mm wide, flat, scabrid on margins and keels, stiff. *Bracts* 3 or 3 plus 1 very small bract, relatively short (up to 120 mm), upright, later reflexed, stiff. *Inflorescence* a single spike, ovoid-cylindric to subglobose, 5–14 mm long by 6–10 mm wide, dense golden-green (rust-coloured under unfavourable conditions). *Spikelets* numerous, ovate-lanceolate in outline, 3–5.5 mm long (average length 3.97 mm), fertile glumes 2, unequal, plus third upper reduced hyaline empty glume, lower glume 7-nerved, subtending bisexual floret, middle 5-nerved, subtending male, rarely bisexual floret; keels green, wingless, glabrous or sparsely scabrid, excurrent into slender, acuminate, slightly recurved mucro (0.25–0.70 mm long). *Stamens* 3, anthers linear, connective slightly produced and red. *Style* far exceeded in length by style branches. *Nut* 1 (rarely 2), small (approximately 1 mm long), obovoid, golden turning bright red-orange later black, slightly apiculate.

BOTSWANA—2525 (Mafikeng): Kanye district, source of Ramongola river (-AB), *Hilliary and Robertson* 576 (PRE).

TRANSVAAL—2288 (Maasrroom): 2 miles E of Donderhoek (-DD), *Killick* 1533 (NU).

—2329 (Pietersburg): Haenertsburg (-DD), *Pott* 13641 (PRE).

—2330 (Tzaneen): Westfalia estate, Duiwelskloof (-CA), *Scheepers* 167 (PRE); Magoesbaskloof (-CC), *Winter & Codd* 135 (PRE); do. *Codd* 3076 (PRE); Tzaneen, *Phillips* 3285 (PRE).

—2428 (Nylstroom): Warmbaths (-CD), *Leendertz* 6199 (PRE).

—2527 (Rustenburg): Rustenburg (-CA), *Leendertz* 3428 (PRE).

—2528 (Pretoria): Aapies River (-CA), *Leendertz* 6216 (PRE); Pretoria, *Repton* 734 (PRE).

—2529 (Witbank): near Groblersdal (-AB), *Acocks* 20901 (PRE).

—2530 (Lydenburg): Waterfall (-CB), *Rogers* 14398 (PRE).

—2531 (Komatipoort): Nelspruit (-AD), *Breyer* 17978 (PRE); Pretoriuskop, *van der Schijff* 1981 (PRE).

—2627 (Potchefstroom): Krugersdorp. Farm Gladysvale (-BB), *Rodin* 3921 (PRE).

—2628 (Johannesburg): Rietvallei Farm, Johannesburg (-AA), *Mogg* 14769 (PRE); Frankenwald, *Rose Innes* 7 (PRE).

—2630 (Carolina): Marimstad (-CA), *Pott* 5226 (PRE).

SWAZILAND—2631 (Mbabane): Black Mbuluzi Valley Swamp (-AA?), *Compton* 28258 (PRE); Marikiana Swamp (-CA), *Compton* 28460 (HSS, PRE); near Hlatikulu on Goedegun Road (-CD), *Ross* 1477 (NU).

—2731 (Louwsberg): Goedegun (-AA), *Ross* 1430 (NU).

NATAL—2730 (Vryheid): Pongola River (-AD), *Getliffe* 285 (NU); on Louwsberg Road near Vryheid (-DD), *Getliffe* 283 (NU); do. *Ross* 1212 (NU); do. *Ross* 1216 (NU).

—2830 (Dundee): Klip River District, near Wessels Nek (-AC), *Pentz and Acocks* A10269 (PRE); near Nqutu on Qudeni Road (-BA), *Edward* 2190 (PRE); Mtunzini, Hamewith (-CC), *Mogg* 6028 (PRE).

—2929 (Underberg): Estcourt district, Blaauwkrantz River (-BB), *Getliffe* 267 (NU); Bergville (-CD), *Edwards* 2357 (PRE).

—2930 (Pietermaritzburg): Lidgetton (-AC), *Mogg* 801 (PRE); Karkloof, *Gordon-Gray s.n.* (NU); Howick, *Getliffe* 223 (NU); Albert Falls (-AD), *Dement* 28 (NH, NU); Town Bush Valley, *Getliffe* 309 (NU); Greytown (-BA), *Medley Wood* 641 (NH), *Getliffe* 223 (NU); Lilani (-BB), *Hilliard s.n.* (NU); Hermannsburg, *Getliffe* 173 (NU).

—2931 (Stanger): flats near Durban (-CC), *Medley Wood* 4100 (NH).

—3030 (Port Shepstone): near Umtamvuna Pont (-CC), *Getliffe* 30 (NU).

District unknown: Kumbula Mission Station, *Gerstner* 4333 (PRE).

CAPE—3227 (Stutterheim): Stutterheim (-CB), *Acocks* 9240 (PRE).

K. melanosperma has been widely collected in southern Africa no doubt partly because it is conspicuous in the field forming dense stands near water. The species may be recognized by its stout congested rhizomes and the cylindrical head subtended by short bracts which reflex from erect position to an angle of 45° from the culm when older.

Gerstner, in notes accompanying his specimen number 4333 (from Kwa-Zulu), mentioned that culms were used by the Zulus to make “in Xosahne” a sieve for native beer. Grant (in Oliver, 1875) described *K. melanosperma* as a “sweet smelling plant”, the roots of which were pounded by Wezee women and rubbed on their skin as a scent. Their name for this species is “Keetolo” (Grant, l.c.).

Schonland (1922) pointed out that Clarke (1901) distinguished inadequately between *K. melanosperma* and *K. elatior*, having neglected rhizome structure which I believe to be an extremely valuable diagnostic character. Very similar in gross morphology is *K. polyphylla* which is described below.

14. ***K. polyphylla*** Willd. ex Kunth, Enum. Pl. 2, 134 (1837); Boeck., in *Linnaea* 35: 409 (1868); C. B. Clarke in Durand and Schinz, Conspect. Fl. Afr. 5: 531 (1895), and in Thiselton-Dyer, Flora Trop. Afr. 8: 276 (1902) and in Kew Bull. Add. Ser. 8: 93 (1908) (name only); Chermeson, Catal. Pl. Madag. 8 (1931). Type: India, Herb. Willd 1441 (B. holo.—seen in photograph).

Kyllinga macrantha Boeck. in *Linnaea* 35: 420 (1868) p.p.

Kyllinga aromatica Ridl. in Trans. Linn. Soc. 2, ser. 2 Bot.: 146 (1884).

Kyllinga planiceps C. B. Clarke in Durand and Schinz, Conspect. Fl. Afr. 5: 531 (1895).

Kyllinga elatior C. B. Clarke in Durand and Schinz, l.c.: 528 pro parte (Angolan material), Rendle in Catal. Afr. Pl. Welw. 2: 104 (1899).

K. erecta Schum. var. *polyphylla* (Willd. ex Kunth) Hooper, Kew Bull. 26: 580 (1972), Hooper in Hepper, Fl. W. Trop. Afr. ed 2. 3, 2: 307 (1972).

Cyperus aromaticus (Ridl.) Mattf. et Kükenth. in Engler, Pflanzenr. 4, 20: 581 (1836).

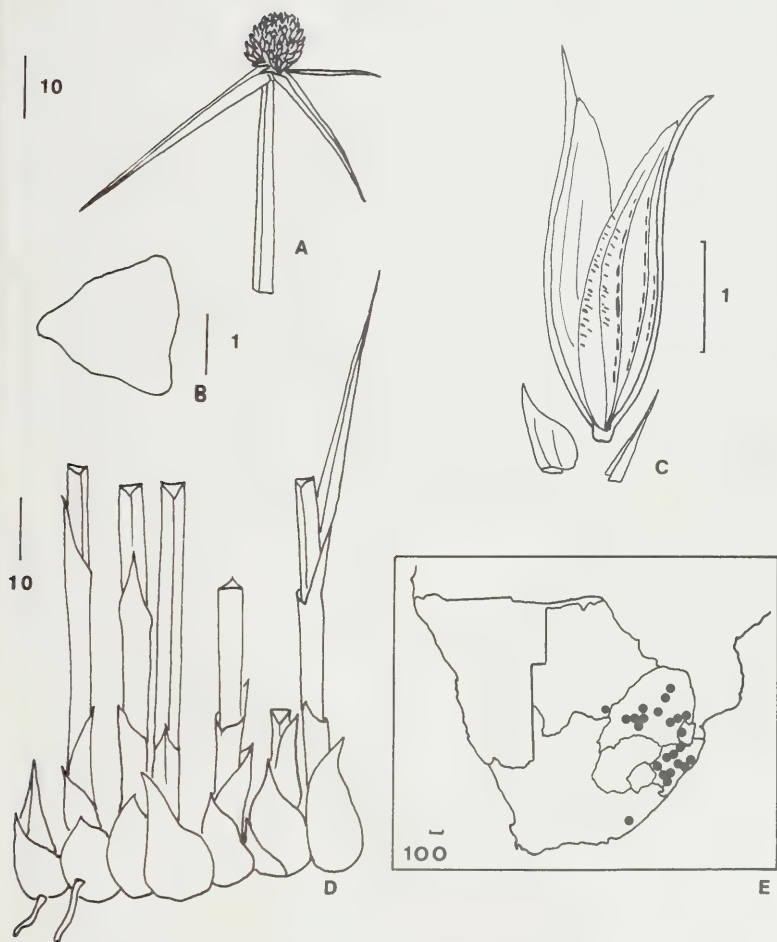


FIG. 16

Morphology and distribution of *K. melanosperma*. A. Inflorescence subtended by short stiff bracts. B. Cross-sectional outline of the culm. C. Whole spikelet with rust streaks on flanks of fertile glumes. D. Congested contiguous stem-bases forming rhizome. E. Distribution of the species in southern Africa. Figure scales in millimetres: map scale in kilometres.

Roots thick, fibrous. *Rhizome* horizontal, stout (5–8 mm diam.), congested (internodes 2–4 mm), covered with red to black acuminate, imbricate scales with transparent membranous margins. *Stem-bases* bulbous-thickened, covered with red-brown cuspidate scales with membranous margins. *Culms* 300–640 mm tall, triangular, glabrous, congested, usually in uniseriate row. *Leaves* 2–4, far apart, less than $\frac{1}{2}$ length of culms, lower leaves reduced to sheaths, upper sheaths shortly laminate; sheath long, membranous, red-brown, blade flaccid, 2–4 mm wide, flat, margins on keel scabrid. *Bracts* 3–8, usually approximately equal in length, 130–210 mm spreading. *Inflorescence* of 3 spikes confluent into subglobose head, greenish-white, central spike 5–10 mm in diam., lateral much smaller. *Spikelets* numerous, ovate-lanceolate in outline, 3–4 mm long. *Fertile glumes* 2, unequal, plus third hyaline reduced upper glume, lowest 9-nerved, subtending bisexual floret, middle 5-nerved, subtending male floret, upper empty; glume keels green, wingless, sparsely spinulose, excurrent into slender acuminate recurved mucro (0.20–0.57 mm long). *Stamens* 3, anthers linear, connective produced and red. *Style* exceeded in length by style branches. *Nut* 1 small (approximately 1 mm long), obovoid, apiculate, golden to red-brown, later black.

NATAL—2931 (Stanger): Durban, roadside Windsor Avenue, Windsor Park Golf Course (-CC), Getliffe 28, 164, 282 (NU).

In May, 1963, a population of *Kyllinga* plants was found growing in light sandy soil on the roadside in Windsor Avenue, Durban. This was a well established but very localised population. Plants were characterised by the 3–6 “flaccid” bracts aggregated at the apex of each culm and subtending a very small inflorescence usually composed of three closely associated, greenish-white, globose heads. Subsequent identification showed these plants to be *K. polyphylla* Willd. ex Kunth. Confirmation was obtained by comparison of dried specimens with sheets in the British Museum.

Mr. J. Lewis who carried out these comparisons, and to whom grateful thanks are due, commented as follows, “The British Museum has many sheets of this species bearing determinate labels *K. polyphylla* in Clarke’s hand. These match Getliffe specimens very well.”

Included amongst the sheets with which the Getliffe specimens were compared was the type of *K. planiceps* C.B. Clarke, a later synonym of *K. polyphylla*.

This single record of *K. polyphylla* is intriguing and difficult to explain, and despite extensive collection along the Natal coast, no other populations have been found. This then is the southern-most record of this tropical species.

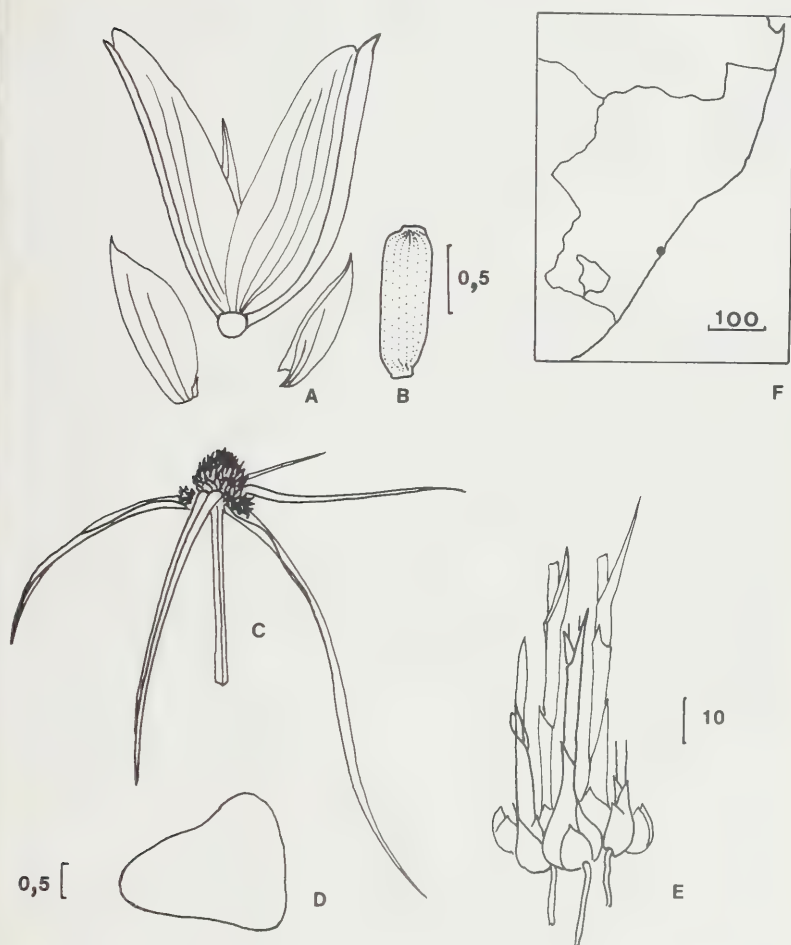


FIG. 17

Morphology and distribution of *K. polyphylla*. A. Whole spikelet with nutlet removed (B). C. Inflorescence of major terminal head and two minor lateral heads, with subtending bracts well developed. D. Cross-sectional outline of culm. E. Congested stem-bases constituting the rhizome. F. Known distribution in South Africa restricted to date to a single record in Natal. Figure scales in millimetres: map scale in kilometres.

Hooper (1972) related *K. polyphylla* to a variety of *K. erecta* which decision is not retained here as *K. erecta* is very different in size and orientation of bracts, rhizome morphology, and inflorescence form. It is also very distinct from *K. elatior* but could be confused with *K. melanosperma* unless attention was drawn to the long bracts and multiple head. The rhizome of *K. polyphylla* in Durban is always obliquely ascending but this may be due to the adjustment due to topdressing on the grassy verge.

GENERAL

The genus *Kyllinga* includes grassland forms such as *K. odorata*, *K. alba* and *K. alata* which appear to be able to tolerate full sun and drier soil than the majority of the genus which exhibits a preference for damp habitats. *K. melanosperma* is intolerant of shading by surrounding vegetation but *K. elatior* thrives in shady situations. In an experiment testing the range of tolerance of soil moisture changes, *K. nemoralis* proved to be extremely adaptable though in natural populations it was always found in damp sandy soils.

The centre of distribution of the genus is undoubtedly tropical Africa. Migration southwards appears to have taken place along two flanks. The western path leads to a distribution in tropical Africa extending into South West Africa as is the case in *K. albiceps* and *K. welwitschii*. The eastern path is more extensive. Some species penetrate as far as Natal and are restricted to coastal areas (*K. polyphylla* and *K. elatior*). Others are more extensive and occur throughout the Transvaal, Orange Free State and Natal (*K. melanosperma*, *K. odorata*, *K. pauciflora*, *K. erecta*, *K. intricata*). Only *K. alba* has been recorded from tropical Africa and from across Botswana to the east coast and south through the northern Cape, Orange Free State and Natal. *K. alata*, in contrast, is limited to southern Africa and has been recorded in the south western Cape.

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